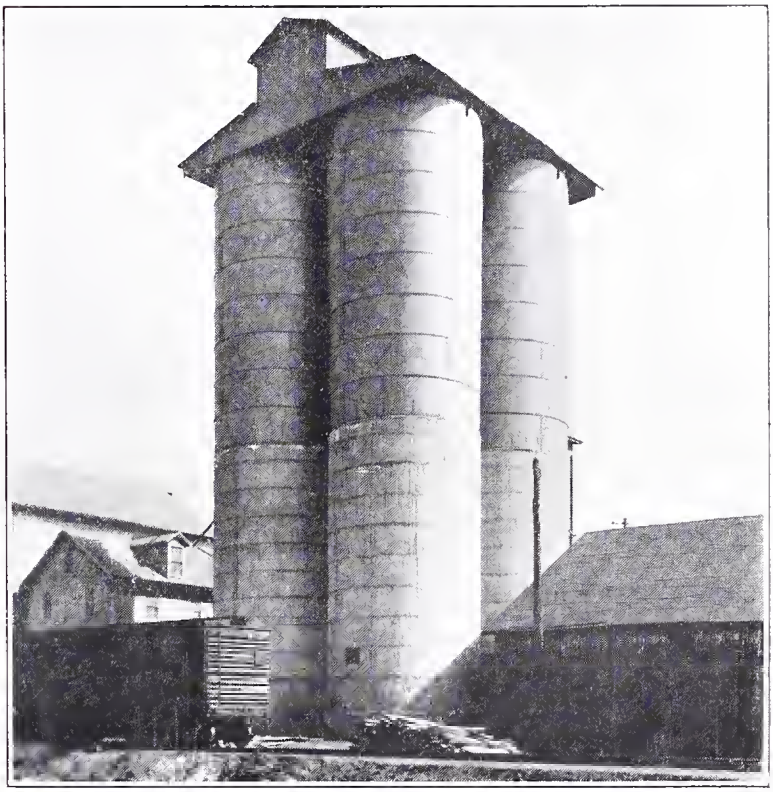
BULLETIN
PENNSYLVANIA DEPARTMENT OF AGRICULTURE.
HARRISBURG, PA.

Vol. 7 September 1924 Number 14

General Bulletin No. 393

PROBLEMS IN MARKETING PENNSYLVANIA WHEAT

By
George A. Stuart
Bureau of Markets



Adequate Storage Needed At All Pennsylvania Mills.

F. P. Willits, Secretary of Agriculture.

Published monthly by direction of the Secretary, Harrisburg, Pa. Entered as second class matter, March 22, 1918 at the Post Office, Harrisburg, Pa., under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of Oct. 3, 1917, authorized, June 29, 1918.

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PENNSYLVANIA DEPARTMENT OF AGRICULTURE

Organization and Services.

FRANK P. WILLITS, *Secretary* JOHN M. McKEE, *Deputy Secretary*

This Department is essentially a service agency created by legislative enactment to deal with administrative, regulatory, investigational, and educational problems which can best be solved through public rather than individual action. The organization provides for coordination and cooperation with the Pennsylvania State College and the U. S. Department of Agriculture. The Department operates through the following bureaus:

ANIMAL INDUSTRY: T. E. MUNCE, *Director and State Veterinarian.*

Prevents and eradicates transmissible diseases of animals and poultry, including tuberculosis of animals in cooperation with Federal Government.

Demonstrates to veterinarians control methods for transmissible animal diseases;

Supervises vaccination for and the prevention of hog cholera, anthrax, black leg and hemorrhagic septicemia;

Protects public from unwholesome meats through ante and post mortem examinations of animals at slaughtering establishments;

Inspects, licenses and furnishes information as to breeding, soundness and conformation of stallions and jacks standing for public service;

Enforces law requiring licensing of dogs and providing for protection of livestock and people from attacks of uncontrolled dogs;

Maintains laboratory for diagnostic research and experimental projects.

PLANT INDUSTRY: C. H. HADLEY, *Director.*

Tests agricultural seeds for purity and germination, and enforces State Seed Law;

Inspects orchards, parks, farms, and plant imports for injurious insects and plant diseases;

Enforces laws governing agricultural practices, disease control and housing;

Places and enforces quarantines and carries on eradication campaigns against insect pests and plant diseases;

Inspects and certifies potatoes for seed purposes;

Makes field tests of insecticides, fungicides and weed killers;

Inspects and licenses Pennsylvania nurseries, and licenses all dealers in nursery stock; makes investigations for the control of injurious insects and plant diseases;

Maintains collections of insects, plant diseases, plants, and seeds, and identifies specimens.

FOODS AND CHEMISTRY: JAMES FOUST, *Director.*

Accomplishes its purpose of protecting Pennsylvania homes against harmful foodstuffs by sampling, analyzing, and bringing prosecution under the laws relating to foods and non-alcoholic drinks, including milk, cream, butter, ice-cream, eggs, sausage, fresh meats, soft drinks, fruit syrups, vinegar and kindred food products;

Regulates and issues licenses for the manufacture and sale of oleomargarine;

Licenses and regulates egg-opening plants and cold storage warehouses, maintaining regular inspection and enforcing twelve-month storage limit;

Inspects milk plants and creameries and regulates weighing, testing, buying and selling of milk and cream on a butterfat basis;

Protects honest manufacturers, importers, selling agents and ultimate users of feeding stuffs, fertilizers, lime products, linseed oil, paint, putty, turpentine, insecticides and fungicides, by means of annual registrations followed by inspections, analyses, prosecutions and the publication of the analyses of these products;

Analyses special samples for residents of the State at the rate of $1.00 a sample for feeding stuffs, lime products and linseed oils.

MARKETS: P. R. TAYLOR, *Director.*

Investigates and assists in the marketing of farm products; at present chiefly grain and hay, fruits and vegetables, poultry and eggs, and tobacco;

Compiles and distributes daily market information as to supplies, shipments and prices;

Advises growers on transportation of agricultural products;

Assists cooperative associations and public markets;

Establishes standard grades of farm products and maintains inspection;

STATISTICS: L. H. WIBLE, *Director,*

Assembles and disseminates essential statistics and facts pertaining to the agriculture of the State, from monthly reports rendered by hundreds of volunteer crop correspondents, information which assists the producer in his sales and interests all industries which deal with agricultural products;

Cooperates with U. S. Bureau of Agricultural Economics in joint crop and livestock reporting and publishes annual and monthly summaries of the data;

Compiles dates of county and local fairs and assembles data pertaining to their success and results during each year.

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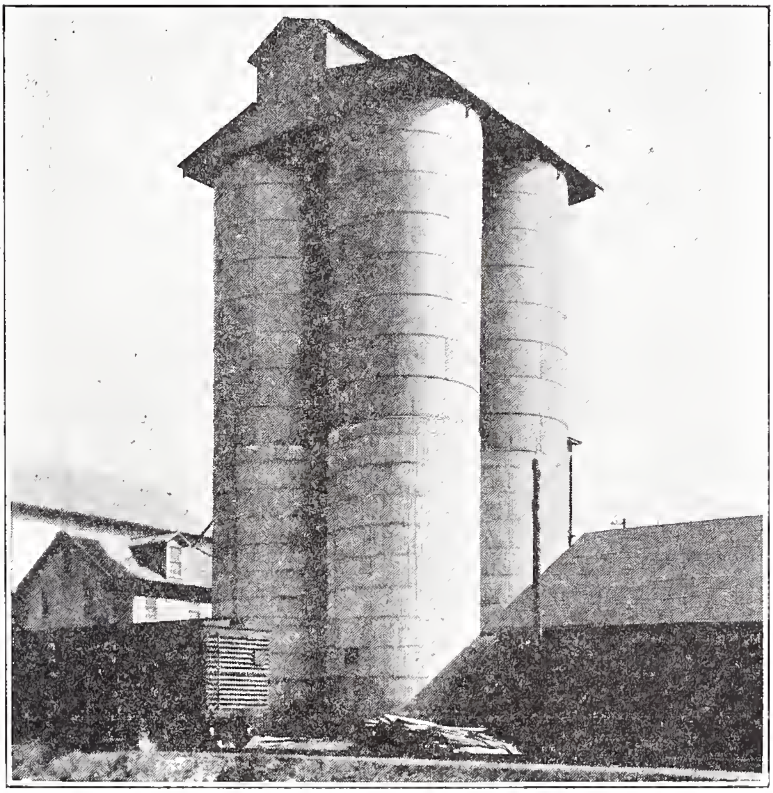

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PROBLEMS IN MARKETING PENNSYLVANIA WHEAT.

By George A. Stuart.

Recommendations.

Suggestions for Farmers

Plant clean seed of pure varieties. Samples of seed wheat taken from drills indicate that some farmers are planting wheat containing garlic and a large amount of weed seeds.

Plant only one variety of wheat on each farm. Where possible farmers can profit by cooperating to produce only one variety in a community.

Select that variety which gives the highest yield of dark, vitreous-texture wheat such as Pennsylvania No. 44, Red Rock, Fulcaster, Leap's Prolific and Forward. In sections where mills can not blend with Spring wheat, select a variety which will produce a starchy wheat for pastry flour.

Eradicate garlic by planting garlic-free seed and by rotating crops.

Reduce costs and increase profits by producing more wheat per acre.

Provide suitable farm storage for wheat. Storage should permit fumigation to control moth and through ventilation to prevent damage from moisture. Such storage is essential for securing the best grades of wheat.

Sell by grade and demand premiums for the best grades.

Suggestions for Millers

Purchase by grade. This encourages the production of better wheat.

Build more storage space.

Install dryers to reduce insect damage and remove infested kernels. This also reduces moisture content and increases milling yield and quality of flour.

Segregate textures and store wheat of each texture separately.

Mill soft-texture wheat separately and make pastry flour.

Mill hard-texture. Soft Winter wheat separately and blend with 50 per cent Hard Red Spring wheat to meet demands of bakers for bread purposes.

Mill uniform flour for all purposes.

Suggestions for Bakers

Cooperate with local millers to secure the blend of flour best suited to your needs.

Use as much of Pennsylvania-milled flour as possible for bread, pastry, pretzels, crackers and ice cream cones.

The slogan—"Made from Pennsylvania Flour" will appeal to Pennsylvania people and encourage a more favorable purchasing attitude.

WHEAT IMPORTANT PENNSYLVANIA CROP.

For many years, wheat has held the important position of third in value among the field crops of Pennsylvania, being surpassed in value only by hay and corn. At the present time it is closely pressed for third position by the increased potato production. Statistics show that there has been very little variation in acreage planted to wheat during the last eleven years even though there had been special agitation to increase the acreage during the war.

Year	Acreage	Yield Per Acre	Total Yield
1913	1,296,000	17.0	21,962,000
1914	1,312,000	18 1	24,272,000
1915	1,312,000	19.0	24,928 000
1916	1,333,500	18.8	25,070,500
1917	1,382,000	19.1	26,400,000
1918	1,420,700	18.3	26,032,700
1919	1,424,900	16.5	23,454.000
1920	1,356,700	17.1	23,188 000
1921	1,317,100	17.6	23,271,500
1922	1,305,600	18.8	24,634 080
1923	1,260,960	19.1	24,380,710

Average acreage for 11 years	1,337,405
Average Yield per year for 11 years	24 317,590
Average yield per acre	18.2 bu.

These figures[1] show that there is apparently a fairly constant crop rotation in Pennsylvania in which wheat holds an important position. To increase or decrease the acreage requires a complete reorganization of farm practice. There are 202,250 farms in the State of Pennsylvania and the average production for eleven years of 24,317,590 bushels of wheat gives an average of approximately 120 bushels of wheat per farm. As there are many farms, however, which do not have wheat in their crop rotation the general average in the wheat producing counties is raised to approximately 250 bushels per farm.

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[1] Bureau of Statistics, Pennsylvania Department of Agriculture.

County	No. Farmers	No. Bushels	Per Farm
Lancaster	11,307	2,742,187	242.5 bu.
York	7,818	2,001,966	256.0 bu.
Franklin	3,884	1,647,014	424.0 bu.
Berks	6,089	1,217,086	200.0 bu.
Chester	5,508	1,157,429	210.0 bu.
Cumberland	3,115	1,112,580	357.1 bu.
Adams	3,451	887,071	257.3 bu.

Wheat production per farm is greatest in the counties which have tobacco and corn in the crop rotation. The farmers in these counties either feed steers or are more or less interested in dairying and need the straw for bedding and to increase the volume of manure for the tobacco and corn crops.

In the early days of wheat growing in Pennsylvania, the State was noted for the quality of wheat produced because few varieties were grown and those varieties were mostly of the Fulcaster strain. Through the lack of interest on the part of millers in purchasing by grade and paying a premium for the best quality wheat, the farmer became more interested in yield per acre. Consequently, new varieties were brought into the State which gave slightly better yields but are of poorer milling quality for bread-baking purposes. The good old Fulcaster and some of its better related strains have been replaced in many sections by varieties which are supposed to be better yielders.

Conditions could be improved if farmers would abandon some of the varieties which they are accustomed to growing in favor of a few recommended varieties. Such varieties as Red Rock, Pennsylvania No. 44, Fulcaster, Leap's Prolific, and Forward which give high yields of dark vitreous texture wheat, should be given first consideration. In sections where mills can not blend with spring wheat, a variety which will produce a starchy wheat for pastry flour should be selected. These varieties in most cases will increase production per acre and are a better milling quality.

The local flour trade can be regained only by better and stronger flour, therefore, it is necessary for the farmers to grow the quality of wheat which will mill such flour.

Additional information on the best variety of wheat to grow can be secured from the local county agents or the extension department of Pennsylvania State College.

TOO MANY VARIETIES OF WHEAT GROWN.

It has been estimated that there are approximately 45 different varieties of wheat grown in Pennsylvania, which makes it impossible to load a car of uniform grade or for a miller to mill a uniform flour. The following is a list of the varieties with their estimated acreage:

TABLE 1.

VARIETIES OF WHEAT GROWN IN PENNSYLVANIA WITH ACREAGE AND PER CENT OF TOTAL GIVEN.[1]

Variety	Acreage	Per cent
China	42,400	3.0
Climax	6,000	.4
Currell	2,700	.2
Dawson	2,100	.1
Democrat	600	-----
Diehl-Mediterranean	20,000	1.4
Durum	500	-----
Fulcaster	335,200	23.4
Fultz	236,500	16.6
Fultzo-Mediterranean	22,200	1.6
Gipsy	1,000	.1
Goens	500	-----
Gold Coin	13,700	1.0
Gold Drop	400	-----
Grand Prize	14,500	1.1
Harvest Queen	200	-----
Jones Fife	6,100	.4
Leap	25,800	1.8
Martin	1,100	.1
Marquis	2,600	.2
Mealy	17,900	1.2
Mediterranean	132,600	9.3
Nigger	2,100	.1
Penquite	200	-----
Poole	91,900	6.4
Portage	-----	-----
Prosperity	4,500	.3
Purple Straw	-----	-----
Red Clawson	3,600	.3
Red Fife	2,400	.2
Red May	6,100	.4
Red Wave	107,700	7.5
Rudy	52,200	3.7
Russian Red	7,200	.5
Sehonacher	1,000	.1
Silver Sheaf	2,900	.2
Turkey	1,900	.1
Others not reported (2)	261,937	18.3
Total	1,429,537	100.0

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[1] United States Department of Agriculture, Bulletin No. 1074.

[2] The acreage of Pennsylvania 44, due to high yield and desirable milling quality, has been greatly increased within the last three years and is to-day one of the leading varieties.

MILLING TESTS SHOW SUPERIOR VARIETIES.

The large number of varieties of wheat grown in the State or even in a community make it almost impossible for the miller to mill a uniform quality of flour. The Pennsylvania State College in cooperation with the Bureau of Markets conducted milling and baking tests with the more or less popular varieties to ascertain which varieties from a good production standpoint give the best milling and baking results when grown in different parts of the State.

The Red Rock variety has the highest bread making qualities of the Soft Red Winter wheats, closely followed in order by Pennsylvania 44, Fulcaster, Fultzo-Mediterranean, Fultz and Leap's Prolific. The poorest variety and one which should not be considered for a bread flour is the Red Wave. However, the Red Wave grown in the southeast section was much better than the Red Wave grown in the other sections of the State and raised the general average for the variety above normal on all factors.

The baker requires a flour of approximately 11 per cent gluten, standard ratio, low ash and approximately 60 per cent water absorption. The results of the milling test on varieties gives conclusive proof that the Pennsylvania flour must be strengthened to warrant absolute uniformity in the factors desired by the baker.

TABLE II

MILLING AND BAKING TESTS OF VARIETIES GROWN IN DIFFERENT SECTIONS OF THE STATE

Variety and Section of State	Protein	Flour Yield	Water Absorption	Loaf Volume	Bread Color	Bread Texture
Red Rock						
West	11.4	71.5	61.2	2230	96.0	89.5
Northeast	10.2	65.9	59.7	2280	96.3	90.5
Southeast	12.7	66.2	58.8	2480	97.3	93.0
Pennsylvania 44						
West	8.8	71.6	58.2	2050	93.0	88.5
Northeast	10.1	70.8	58.2	2100	93.5	89.3
Fulcaster						
Northeast	9.8	68.7	59.7	1960	93.8	90.0
Fultzo Mediterranean						
Southeast	11.4	67.3	55.9	2260	87.8	89.5
Northeast	10.5	62.1	60.6	2050	94.5	90.5
Fultz						
West	10.1	72.2	59.1	2230	95.5	91.5
Leap						
West	9.1	70.9	56.5	2080	94.5	90.0
Northeast	10.0	66.9	55.6	2000	93.5	90.5
Red Wave						
West	9.4	63.1	55.6	1620	78.5	86.5
Northeast	9.1	69.1	53.8	1800	91.0	89.5
Southeast	10.1	67.0	57.4	2100	94.3	92.5

TABLE III

MILLING AND BAKING TESTS SHOWING DIFFERENCES IN VARIETIES OF WHEAT

Variety	Number of Tests	Protein	Flour Yield	Water Absorption	Loaf Volume	Bread Color	Bread Texture
Red Rock	3	11.4	66.5	59.9	2330	96.5	91.0
Pennsylvania 44,	2	9.4	71.2	58.2	2075	93.3	88.9
Fulcaster	1	9.8	68.7	59.7	1960	93.8	90.0
Fultzo Mediterranean,	2	10.9	64.7	58.2	2155	91.1	90.0
Fultz	1	10.1	72.2	59.1	2230	95.5	91.5
Leap's Prolific	2	9.5	68.8	56.0	2040	94.0	90.2
Red Wave	3	9.5	66.4	55.6	1840	87.9	89.5

Some strains of Fulcaster type gave a gluten percentage as high as approximately 11 per cent and water absorption of approximately 60 per cent while tests made of the Red Wave, a variety originating in New York from a cross between Early Red Clawson and an unnamed wheat of Russian parentage, gave a gluten percentage as low as 6 per cent and water absorption of 52.3 per cent.

FARMERS' PROBLEMS AND THEIR SOLUTION.

Weeds: Garlic and foreign material are two of the problems with which farmers have to contend. It is not known definitely how wild garlic was first introduced, but it is supposed to have been brought into the State by the introduction of new seed wheat varieties from states already infested with garlic, and probably is spreading by the same method. Foreign material consists largely of corn cockle, chess, binderweed, darnel, etc. It is increasing in quantity and spreading over the State. Millers have not encouraged the growing of cleaner wheat by paying a premium for it. Farmers have a tendency to plant their own wheat for seed without thorough cleaning. For example, samples taken from some of the drills at planting time showed that one farmer was sowing 16,000 garlic bulblets and 44,000 cockle seed to the acre and another farmer was sowing 5,000 garlic bulblets and 84,000 cockle seed per acre. In both cases the wheat graded No. 4 Red Winter Garlicky because of cockle and was inferior for milling flour for this reason.

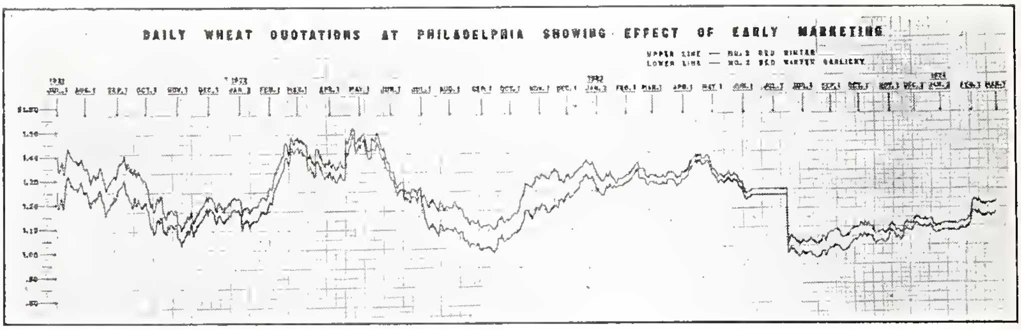
Grain Moth: Angoumois Grain Moth was first recorded in this country in 1728. At different times it has so gained in numerical abundance that farmers have suffered serious losses from its presence. Pennsylvania is just passing through one of those periods and during the past three years has suffered an annual loss of from $1,000,000 to $3,000,000. No organized effort has been made by the farmers in any community to control the pest. Information on methods of control can be secured for the asking by applying to the local county agent, the Pennsylvania State College or the State Department of Agriculture.

High Moisture Content: The average rainfall in the wheat producing counties of Pennsylvania during July at harvesting time ranges from 3.73 inches to a little over 5 inches. The weather conditions may be fine when the wheat is cut but at times it is very difficult to get the grain dry enough for threshing direct from the field. Well-built shocks have a great deal to do with protecting the grain. Even when wheat is well shocked with cap bundles, continued exposure brings on a change in the outer bundles which are poorly protected at best. After a shock has stood a month or even less in wet weather it has been found that samples of wheat taken from the outside of the shock are at least one grade lower than those taken from the inside. Wheat may lose as much as a pound per bushel in one heavy shower if the wheat is poorly shocked. It will also become bleached and sprouted and lose its natural bright color. Tests have shown that badly weathered and bleached wheat has decreased in protein content. Much can be done by the wheat growers in Pennsylvania to decrease moisture content by better shocking and stacking of their grain before threshing.

Marketing: Wheat is usually harvested at a time when the farmer is in need of ready cash. No matter how great the surplus, wheat can always find a cash market, but not always at a desirable price. Because of the lack of licensed country elevators and warehouses, the farmer can not store his grain and make use of warehouse receipts at the banks to secure money. He must either sell immediately at the prevailing low price or store his grain on the farm, assuming all risks of storage himself without even a chance to use the grain as security for credit.

Studies of the movement of wheat to market in other sections of the country indicate that about 60 per cent of the demand for wheat for milling and export usually occurs between July 1 and January 1, or an average of about 10 per cent per month. Because of lack of storage rather than because of an actual surplus, quite a volume of wheat has been shipped from Pennsylvania each season to terminal markets for export or to mills in other eastern states. Records at Philadelphia and Baltimore show that approximately 85 percent of this movement occurs during the months of July, August and September and is the chief reason for the low price which usually prevails at this period. While there are no definite figures available, it is obvious that there is a surplus of Soft Red Winter wheat on the market at this season of the year.

CHART I



The trend of prices for both No. 2 Red Winter wheat and No. 2 Red Winter Garlicky are shown. Note the drop in prices that came during July and August of 1922 and 1923.

MILLERS NEED MORE AND BETTER EQUIPMENT.

The increased volume of business handled through the bakeries made necessary the introduction of much labor saving machinery. The efficient use of such machinery required a flour of absolute uniformity and greater strength than was usually furnished by Pennsylvania mills. The Pennsylvania millers did not adjust their methods to meet these changed conditions and suffered in competition on the market with the western millers.

The lack of uniformity in the flour purchased from local Pennsylvania mills soon resulted in the use of western brands of flour in many of the farm homes where the baking of bread was continued. The Pennsylvania miller soon found it profitable to handle one or more brands of western milled flour in competition with his own. When the producer of Pennsylvania wheat as a class refused to use the flour made from his own grain the last home market for bread flour was closed. The two outlets remaining were for pastry and export in competition with the world market. This flour which had lost favor at home naturally did not bring a high price in a highly competitive market. The low price usually received for the flour was reflected back by the miller to the farmer in the price paid for the wheat.

The failure of the farmer to standardize on a few of the best varieties and the neglect on the part of the miller to produce the uniform flour required by the changed conditions, caused the wheat from Pennsylvania farms to lose much of the very satisfactory and profitable home market which it had previously enjoyed.

Need of Storage: The great majority of Pennsylvania mills are not equipped with sufficient storage bins to permit them to enjoy the benefits of accumulating a large stock of wheat shortly after threshing when the market is flooded. Among these advantages of storage are:—

1. The securing of sufficient supply to insure year round operation.
2. The purchase of wheat before it can be damaged by the Angoumois Grain Moth, or high moisture content as such damage can be prevented by the use of a commercial grain drier and proper storage.
3. Sufficient space to store by grade and texture to insure absolute uniformity and quality by blending.

At the present time the available storage space is filled quickly and the mill is then usually operated on daily receipts, supplemented from the storage stocks. As a result the mills are forced to shut down many times for two or three months because of a shortage in the local wheat supply.

In communities where there are no local mills, or where millers and shippers are not willing to cooperate with farmers in improving the quality and price of wheat handled, farmers should seriously consider the establishment of a cooperative elevator to handle their wheat. Through the control of a suitable elevator with cleaning and drying machinery, the farmer will be assured of the chance to put his wheat in the best possible condition and to receive the highest market price when he is ready to sell. As a part of its service, such an elevator can store the grain for several months, and issue negotiable warehouse receipts, which the farmers may use for collateral for bank loans. It must be remembered, however, that this will be a purely business enterprise and will succeed providing it has good management and a sufficient volume of business and the loyal support and patronage of the farmers of the community.

Experience in the middlewest where farmers' elevators are numerous indicates that such an elevator must have a capacity of at least 15,000 bushels to be successful and must handle at least 100,000 bushels a year in its ordinary business. Storage of grain in such an elevator for a period of several months would modify these figures to some extent as it would reduce the volume of business. The number of storages, either mill or elevator, required to handle the total production of the important wheat producing counties is shown in Table IV. The area per storage indicates that the average distance from farm to nearest elevator would not need to be more than five miles in most cases.

TABLE IV

STORAGE CAPACITY NECESSARY TO HANDLE WHEAT CROP[1]

County	Production (bushels)	Area of County (square miles)	Number of Storages ([2])	Area per Storage (square miles)
Lancaster	2,559,285	941	21	45
York	2.016,214	903	17	53
Franklin	1,562,788	751	13	58
Berks	1,241,994	865	10	86
Chester	1,130,783	777	10	77
Cumberland	1,098,221	528	9	58
Adams	897,926	528	7 or 8	75
Lebanon	675,180	360	5 or 6	60
Bucks	630,216	608	7	121.6
Lehigh	594,401	344	4 or 5	86
Northampton	555,702	372	4	93
Dauphin ([3])	550,224	521	4	130
Center	540,986	1,146	4 or 5	229
Westmoreland	522,603	1,039	4	259
Columbia	404,347	479	3	159
Union	367,284	306	3	101
Mifflin	323,105	398	3	132
Clinton	175,182	878	2	438

[1] Pennsylvania Bureau of Statistics.

[2] Based on elevators or mills with annual turnover of 120,000 bushels each.

[3] A considerable area of Dauphin county, and of Center, Westmoreland, Columbia, Union, Mifflin, and Clinton counties, is not suitable for agricultural purposes.

HOW SHIPPERS' PRACTICE AFFECT FARMERS.

Since the millers were unable to purchase the wheat as fast as the farmers have wished to market it, many country shippers of grain opened for business at various shipping points. These shippers are divided into two classes: those who have elevator or warehouse facilities and those who do not. The grain shipper who has elevator or warehouse facilities is usually equipped with cleaning machinery and some storage space which enables him to load a car of uniform grade. If this shipper purchases by grade and segregates the hard and soft textured wheat and ships a car of one grade and one texture, he can find a very ready market to millers who do not have a sufficient local production close to their mills for continuous milling.

The other type of country shipper is the "track buyer" who purchases his wheat from the farmer and loads directly into the car without grading, cleaning or segregating according to texture. Under this system the shipper is not able to load a uniform grade of wheat in a car, and from such a shipment it is obviously impossible for any miller to produce a uniform quality of flour. By this method a single wagonload of poor quality or containing moth or garlic will contaminate an entire carload and reduce its grade and value accordingly. This method of shipping is inexpensive but is one of the serious obstacles preventing permanent wheat improvement and uniform milling.

DISCOUNTS AT TERMINAL MARKETS.

The records of car arrivals at terminal markets indicate that approximately 85 per cent of the shipments of Pennsylvania wheat arrive during the first three months after harvesting. This is usually a time of year when the terminal markets are crowded with large shipments of wheat and corn from the west for export, and since a large percentage of Pennsylvania wheat has moth infestation, garlic and high moisture, a large amount must pass through the grain driers before it can be stored. Sometimes there has been as many as 2,000 cars on track waiting to be unloaded or dried. At this time of year the weather is hot and grain can go out of condition very quickly, so that the lower grades receive heavy discounts.

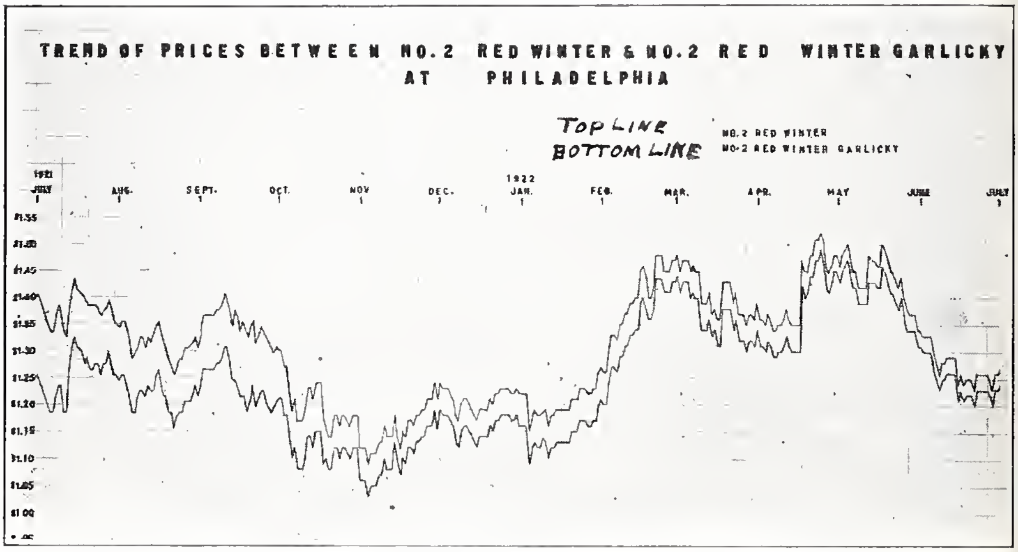
Garlicky wheat is divided into three classes: light garlicky, when not more than three garlic bulblets are found in 1,000 grams; medium garlicky, when more than three but less than fifteen garlic bulblets are found in 1,000 grams; and heavy garlicky when more than fifteen garlic bulblets are found in 1,000 grams. To store garlicky wheat under the three classes, would require three times as many bins as it did under the old grades. Farmers of Pennsylvania are not receiving any benefit from the change on grade because there is not enough storage space available at terminal markets to keep these grades separate. Garlicky wheat is stored according to the grade of the wheat without considering the amount of garlic it contains, Pennsylvania wheat, regardless of the fact that most of it grades light garlicky, is stored with wheat of similar grade from other states which grades mostly heavy garlicky, and receives the same discount. This unfair discount at terminal markets does not encourage the eradication of garlic in Pennsylvania.

FEDERAL WHEAT GRADES DESCRIBED.

Previous to December 1, 1917, the marketing system which was in effect before the establishment of Federal supervision greatly handicapped grain dealers by the uncertainty as to the grades which would be assigned the same grain in different markets. Owing to the fact that there were no uniform standards, a man who bought a car of wheat in Kansas City and graded to the standards of Missouri, was at a disadvantage in selling it in Chicago when it would be graded according to the standards of Illinois. This difficulty could only be remedied by the adoption of uniform grades, and by the licensing of competent inspectors and supervising their work to prevent local influence.

The Federal Grain Standards for wheat were put into effect December 1, 1917, but before the law became fully operative the establishment of fixed prices by the government as a war measure brought about a condition which made standards more or less ineffective. However, as soon as the guaranteed prices on wheat were removed, there was a decided decline in the market price paid for various grades which led many producers and grain dealers to believe that the new system of grading was responsible for the price decline. Criticism of the large discounts suffered by producers in Pennsylvania led the Pennsylvania Department of Agriculture to investigate the grading of Pennsylvania wheat.

CHART II.



This chart shows how the presence of garlic in No. 2 Red Winter Wheat reduces the price on the Philadelphia market.

The grades in the following table were not decided upon until after about 11 years of study by experts. Tests were made on each of the factors to determine its influence on the milling quality of the wheat, or its ability to stand long periods of time in storage, or sudden changes in temperature during bulk shipments for export. Explanation and definitions of the factors used in the grades and how each factor is determined will follow the grade table.

TABLE V

UNITED STATES AND PENNSYLVANIA GRADE REQUIREMENTS FOR SOFT RED WINTER WHEAT

			MAXIMUM LIMITS OF					
			Damaged Kernels		Foreign Material other than Dockage		Wheats of other classes	
Grade (1) No.	Minimum Test Weight per Bu.	Moisture	Total	Heat Damage	Total	Matter other than Cereal Grains	Total	Durum
Pounds	Pct.	Pct.	Pcts.	Pcts.	Pct.	Pct.	Pct.	Pct.
1	60	13.5	2	0.1	1	0.5	5	2
2	58	14.0	4	.2	2	1.0	10	3
3	56	14.5	7	.5	3	2.0	10	10
4	54	15.5	10	1.0	5	3.0	10	10
5 (2)	51	15.5	15	3.0	7	5.0	10	10
Sample*								

*Sample grade shall be wheat which does not come with the requirements of any of the grades from No. 1 to No. 5, inclusive, or which has any commercially objectionable foreign odor except of smut, garlic, or wild onions, or is very sour, or is heating, hot, infested with live weevils or other insects injurious to stored grain, or is otherwise of distinctly low quality, or contains small, inseparable stores or cinders.(3)

(1). The wheat in grades Nos. 1 to 4 inclusive, shall be cool and sweet.

(2). The wheat in grade No. 5 shall be cool, but may be musty, or slightly sour.

(3). After August 15, 1924 all wheat infested with insects injurious to stored grain will be given the grade term "Weevily wheat" instead of "Sample grade." Definition of "Weevily wheat" is given on page 14. The studies reported in this bulletin are based upon the grade classification in effect previous to August 15, 1924.

GRADE TERMS DEFINED (SOFT RED WINTER WHEAT.)

For the purposes of the official grain standards of the United States for wheat:

WHEAT.—Any grain which, when free from dockage, contains more than ten per cent of grain of a kind or kinds other than wheat shall not be classified as wheat. The term "wheat" in these standards shall not include emmer, spelt, and einkorn.

BASIS OF DETERMINATIONS.—Each determination of dockage, moisture, temperature, odor, onions, garlic, and live weevils or other insects injurious to stored grain shall be upon the basis of the grain including dockage. All other determinations shall be upon the basis of the grain when free from dockage.

PERCENTAGES.—Pencentages, except in the case of moisture, shall be percentages ascertained by weight.

PERCENTAGE OF MOISTURE.—Percentage of moisture in wheat shall be that ascertained by the moisture tester and the method of use thereof described in Circular No. 72, and supplement thereto, issued by the United States Department of Agriculture, Bureau of Plant Industry, or ascertained by any device and method giving equivalent results.

TEST WEIGHT-PER-BUSHEL.—Test weight per bushel shall be the weight per Winchester bushel as determined by the testing apparatus and the method of use thereof described in Bulletin No. 472, dated October 30, 1916, issued by the United States Department of Agriculture, or as determined by any device and method giving equivalent results.

DOCKAGE.—Dockage includes sand, dirt, weed, seeds, weed stems, chaff, straw, grain other than wheat, and any other foreign material, which can be removed readily from the wheat by the use of appropriate sieves, cleaning devices, or other practical means suited to separate the foreign material present; also undeveloped, shriveled, and small pieces of wheat kernels removed in properly separating the foreign material, and which can not be recovered by properly rescreening or recleaning. The quantity of dockage shall be calculated in terms of percentage based on the total weight of the grain including the dockage. The percentage of dockage so calculated, when equal to 1 per cent or more, shall be stated in terms of whole per cent; and when less than 1 per cent shall not be stated. A fraction of a per cent shall be disregarded. The percentage of dockage, so determined and stated, shall be added to the grade designation.

FOREIGN MATERIAL OTHER THAN DOCKAGE.—Foreign material other than dockage shall include all matter other than wheat which is not separated from the wheat in the proper determination of dockage, except as provided in the case of smutty wheat.

CEREAL GRAINS.—Cereal grains shall include rye, barley, emmer, spelt, einkorn, Polish wheat, poulard wheat, corn, grain sorghums, oats, and rice, and shall not include buckwheat, flaxseed, and wild oats.

HEAT-DAMAGED KERNELS.—Heat-damaged kernels shall be kernels and pieces of kernels of wheat which have been distinctly discolored by external heat or as a result of heating caused by fermentation.

TREATED WHEAT.—Treated wheat shall be wheat which has been scoured, limed, washed, sulphured, or treated in such a manner that its true quality is not reflected by the numerical grade designation, including Sample Grade, alone.

GARLICKY WHEAT.—Garlicky wheat shall be all wheat which has an unmistakable odor of garlic or wild onions or which contains garlic or wild onion bulblets in a quantity equal to one or more bulblets in 1,000 grams of wheat.

SMUTTY WHEAT.—Smutty wheat shall be all wheat which has an unmistakable odor of smut, or which contains spores, balls, or portions of balls of smut in excess of a quantity equal to two balls of average size in 50 grams of wheat.

MIXED WHEAT.—Mixed wheat shall be any mixture of wheat not provided for in the classes from I to VI, inclusive.

GRADES FOR MIXED WHEAT.—Mixed wheat shall be graded according to each of the grade requirements common to all of the subclasses of the class of the wheat which predominates over each other class in the mixture, except that (1) all of the grade requirements in any subclass as to the maximum percentage of other varieties of wheat shall be disregarded, and (2) when soft Red Winter wheat so predominates, the grade requirements as to the test weight per bushel shall be those of the subclass Red Winter. The grade designation of mixed wheat shall include, successively, in the order named, the number of the grade or the words "Sample Grade," as the case may be, the word "Mixed," and, in the order of its predominance, the name and approximate percentage of each class of wheat which constitutes 10 per cent or more of the mixture, but if only one class exceeds 10 per cent of the mixture, the name and approximate percentage of that class shall be added to the grade designation followed by the name and approximate percentage of at least one other class.

GRADES FOR TREATED WHEAT.—Treated wheat shall be graded and designated according to the grade requirements of the standard applicable to such wheat if it were not treated, and there shall be added to, and made a part of, its grade designation a statement indicating the kind of treatment.

GRADES FOR GARLICKY WHEAT.—Garlicky wheat shall be graded and designated according to the grade requirements of the standard applicable to such wheat if it were not garlicky, and there shall be added to, and made a part of, its grade designation the word "Garlicky." Garlicky wheat is divided into three classes, Light Garlicky, Medium Garlicky, and Heavy Garlicky. Wheat containing 1 to 3 bulblets inclusive shall be graded Light Garlicky. Wheat containing 1 to 3 bulblets inclusive shall be graded Light Garlicky. Wheat containing 4 to 15 bulblets inclusive shall be graded Medium Garlicky. Wheat containing more than 15 bulblets shall be graded Heavy Garlicky.

GRADES FOR SMUTTY WHEAT.—Smutty wheat shall be graded and designated according to the method described either in paragraph (a) or paragraph (b) of this section.

(a) Before the determination of smut dockage as provided in this paragraph, the wheat shall be graded and designated according to the grade requirements of the standard applicable to such wheat if it were not smutty, except that smut balls shall not be considered as foreign material other than dockage. The loss in weight caused by the removal of smut from the wheat shall be ascertained by scouring, washing, or otherwise, and shall be calculated in terms of percentage based on the total weight of the grain free from dockage. The percentage so calculated shall be stated in terms of whole per cent and a half per cent. A fraction of a per cent when equal to or greater than a half shall be treated as a half and when less than a half shall be disregarded. The percentage of the "smut dockage," so calculated and stated, shall be added to the grade, designation preceding the statement of dockage, if any.

(b) Smutty wheat shall be graded and designated according to the grade requirements of the standard applicable to such wheat if it were not smutty, except that (1) smut balls shall not be considered as foreign material other than dockage, and (2) when the amount of smut present is so great that any one or more of the grade requirements of the grades from No. 1 to 5, inclusive, can not be applied accurately, the wheat shall be classified as sample grade. For all grades there shall be added to and made a part of the grade designation, preceding the statement of dockage, if any, the word "Smutty."

WEEVILY WHEAT.—Weevily wheat shall be all wheat which is infested with live weevils or other insects injurious to stored grain.

Weevily wheat shall be graded and designated according to the grade requirements of the standards applicable to such wheat if it were not weevily, and there shall be added to, and made a part of, the grade designation the word "Weevily." (This grade became effective August 15, 1924. Studies reported in this bulletin are based upon the grades in effect before August 15, 1924.)

EXPLANATION OF GRADE FACTORS

Influence of Weight-per-Bushel on Grade. The value of "weight-per-bushel" or "test weight" determinations as a rough means of measuring wheat quality has long been recognized by the grain trade and millers, and requirements relating thereto are made in practically all grading rules. It is generally understood that clean wheat with a high test weight gives larger milling yields, and the results from many milling tests indicate that test weight and soundness when considered together are of far more value in appraising quality than when either is considered by itself. The minimum test weights for each grade are: 60 pounds per bushel for No. 1 wheat; 58 pounds per bushel for No. 2 wheat; 56 pounds per bushel for No. 3 wheat; 54 pounds per bushel for No. 4 wheat; 51 pounds per bushel for No. 5 wheat. Less than 51 pounds will grade wheat "Sample Grade."

Influence of Water in Wheat upon Grade. All vegetable matter is known to contain a considerable percentage of water even when it is air-dried. The proportion of water to dry matter in the grain varies, first according to the season of the year; secondly, the section of the country where it is grown; thirdly, the way the grain is handled and stored; and fourthly, the time of harvesting. The water in wheat is not considered as having any food or feeding value, and any additional water which it may be desirable to add to air-dried grain to put it in proper condition for milling or baking purposes can be added at the time of milling cheaper than to purchase it at the price paid for the wheat. With this idea in mind the moisture percentage allowed in each grade was taken as a general average of the country to represent the grain harvested under ordinary care and a very large percentage of the grain should not contain over 14 per cent of moisture when harvested under normal conditions. The effect of water in wheat upon the grade was determined by studying the keeping quality of wheat containing different percentages of moisture in car transportation, storage, boat shipments and milling yields.

It has long been known that grain must be dry when stored and the ingress of moisture prevented, or grain and any similar vegetable matter will heat and become decomposed when stored in quantities. Inspection records show that a large percentage of cars as well as export shipments arrive in a heating condition when containing any appreciable amount of moisture over 14.0 per cent and as the percentage of moisture increases the greater the amount of grain going out of condition because of heat.

In milling, it was found that the higher total yields of mill products are associated with high relative humidity at time of milling and low moisture content of the grain.

Following is maximum amount of moisture allowed in each grade: 13.5 per cent in No. 1; 14.0 per cent in No. 2; 14.5 per cent in No. 3; 15.5 per cent in No. 4; 15.5 per cent in No. 5. Over 15.5 per cent grades wheat "Sample Grade."

Effect of Foreign Material upon Grade of Wheat. Wheat as grown and as marketed in Pennsylvania frequently contains impurities such as rye, ragweed, corn cockle, and garlic. Grain men and millers consider these impurities as inseparable, as they are not easily removed from wheat with the cleaning machinery in general use in grain elevators and flour mills. It is claimed that the presence of these so-called "inseparable" impurities in wheat when milled injuriously affects the baking qualities of the flour. For this reason wheat containing an appreciable amount of any of these impurities is penalized by lowering the grade and reducing the price. Pennsylvania wheat on milling and baking tests has shown that the presence of over 2 per cent of either rye or cockle when milled exerts detrimental effects on the milling and baking qualities. The deleterious effects of rye in wheat are less pronounced than those of corn cockle, but if rye is present in wheat in amounts as high as 2 per cent or more, it naturally lowers the quality when made into bread.

Corn cockle seems to exert exceedingly injurious effects on the volume, color and texture of the loaf, and when present in the amount of 3 per cent or more reduces the percentage of water absorption of the flour. Garlic when present in appreciable amounts, gums the rolls, reduces milling yield and imparts a garlicky odor to the flour and also affects keeping qualities of grain in storage.

The influence of foreign material upon the grade of wheat is as follows:

1% allowed in No. 1 Grade of which 0.5% of this 1% may be matter other than cereal grain.
2% allowed in No. 2 Grade of which 1% of this 2% may be matter other than cereal grain.
3% allowed in No. 3 Grade of which 2% of this 3% may be matter other than cereal grain.
5% allowed in No. 4 Grade of which 3% of this 5% may be matter other than cereal grain.
7% allowed in No. 5 Grade of which 5% of this 7% may be matter other than cereal grain.

Percentages over 7% total or over 5% of matter other than cereal grains will grade Sample Grade.

The Effect of Damaged Kernels upon Grade of Wheat. Many milling tests reveal a direct connection between flour yield and the percentage of sound wheat. With all classes of wheat there is a fairly regular decrease in flour yield as the percentage of sound wheat decreases and the color of flour is effected according to the kind of damage.

2% of damaged kernels allowed in No. 1 Grade of which 1/10 of 1% may be heat damage.
4% of damaged kernels allowed in No. 2 Grade of which 2/10 of 1% may be heat damage.
7% of damaged kernels allowed in No. 3 Grade of which 5/10 of 1% may be heat damage.
10% of damaged kernels allowed in No. 4 Grade of which 1% may be heat damage.
15% of damaged kernels allowed in No. 5 Grade of which 3% may be heat damage.
Over 15% of damaged kernels or over 3% of heat damaged kernels will grade wheat Sample Grade.

GRAIN INSPECTION CHARGES

The charges for grain inspection at the Philadelphia market are as follows: The charge for inspection of in-bound cars is 65 cents per car for export, 90 cents for export when in bond, and 75 cents per car for domestic use. The cost is 75 cents when cars are inspected out of elevators and 55 cents per 1,000 bushels when inspected out for export. When grain is inspected afloat the charge is $1.00 per 1,000 bushels domestic or export. The minimum charge is $1.00. The charge for re-inspection either for export or domestic is 80 cents per car. The charge for sampling cars is 30 cents per car. Opinions on samples are gained at a cost of 40 cents per car to members and 75 cents per car to non-members. The mixing charge is 60 cents per 1,000 bushels and the cleaning charge 60 cents per 1,000 bushels. Drying charges are 75 cents per 1,000 bushels with 75 cents additional per 1,000 bushels for salvage grain. The charges for inspection outside of Philadelphia is left to the discretion of the Chief Grain Inspector and the chairman of the grain committee. The seal record and examination of cars has a charge of 25 cents per car.

OTHER CHARGES AT PHILADELPHIA ELEVATORS

RULES

No grain will be received in store until it has been inspected and graded by authorized Inspectors, unless by special arrangement.

The railroad company will not receive or store at their Girard Point Elevator unsound, unmerchantable or "Sample Grade" grain (except as provided in Note A below), grain from vessels or Grain in bags.

Loss by fire, heating or weevil at owner's risk.

In lightering grain to vessels, this Company assumes no risk of such transfer, either fire or marine.

Warehouse receipts will be issued only by the manager of the elevator, at his office, upon the payment of freight charges, and redeemed only at the same office.

Note A—Exception will be made in the case of "Sample Grade" which has been so graded solely because of moisture content.

CHARGES FOR STORAGE ON EXPORT GRAIN

	Per Bushel
Receiving, weighing and storing from cars, including storage for the first period of 20 days, or parts thereof, and delivery to vessel, either alongside (or by lighter to steamship of the regular line, docking at piers within the harbor limits of Philadelphia)	1 Cent
Storage for each succeeding day	1/25 "
Mixing in store (see Note)	1/8 "
Screening and blowing	1/8 "
Mixing, screening and blowing in store when in one operation	3/16 "
Note.—Mixing (not through storage bins) at time of delivery to cars or vessels	Free
Cooling	½ Net

CHARGES FOR DRYING GRAIN

(These charges are in addition to the elevator charge.)

Nos. 1, 2 and 3 Wheat	½ Cent
No. 4 Wheat	¾ "
No. 5 Wheat	1 "
Sample grade for higher grade	1½ "
Sample grade for sample grade	2½ "

All grain to be dried is to be under the control and supervision of the Inspection Department of the Commercial Exchange.

The above rates will be charged upon the weight of the Grain after being dried. All loss of weight to be borne by the owners of the Grain.

The railroad company does not guarantee to dry Grain within any specified time or to any moisture degree, and will not be responsible for deterioration of Grain due to delay in passing through the dried.

Charge of $1.00 for loading cars or trimming.

FEDERAL GRADES APPLIED TO PENNSYLVANIA WHEAT.

In order to secure authentic information with respect to the grading of Pennsylvania wheat, it was decided to make a survey of the markets supporting an inspection department with licensed inspector using Federal Grades. Through the cooperation of the railroads entering Philadelphia and Baltimore a list was furnished containing car initials, number, point of origin, and date of shipment of all cars of wheat originating in Pennsylvania. Also through the cooperation of the Federal Grain Supervision Office at Philadelphia, a copy of the grade certificate issued against each car was furnished showing the grade and grading factors. The cars were then tabulated as to the points of origin by counties. By following this system we were able to locate the counties showing the greatest number of cars being discounted and the troublesome factors causing off-grades.

The United States Grain Corporation established a uniform discount for grades of wheat below a straight No. 2 Red Winter, and the use of these discounts were continued at the terminal markets. The discount for a particular grade is subtracted from the price paid for a No. 2 Red Winter Wheat. The small quantity of No. 1 Red Winter wheat receives the No. 2 Red Winter price and sometimes a premium.

GRADE DISCOUNTS

Grade No. 3	Red Winter	- 3	cents	a bushel	below	No. 2
" No. 4	" "	- 7	"	"	"	No. 2
" No. 5	" "	- 11	"	"	"	No. 2
Sample Grade	" "	- 12	"	"	up	

In addition a fluctuating discount is applied if the word Garlicky is attached to the various grades. This discount varies according to the supply of garlicky wheat and the demand for it resulting in a discount as high as 22½ cents a bushel at times.

A discount of three cents a bushel is imposed for Grade No. 3 Red Winter with average discount during year 1921, 12.6 cents a bushel added discount if word "Garlicky" is attached. The discount for garlic varies from 0.5 cents to 22.5 cents according to demand at export market. During the first three months when about 85 percent of surplus wheat is marketed in Pennsylvania, the discount is the highest. In July, August, and September, 1921, the average discount was 12.6 cents per bushel at Baltimore and 11.1 cents at Philadelphia and was as high as 22.5 cents and 15 cents, respectively.

TABLE VI

DISCOUNTS ON WHEAT AS MARKETED AND POSSIBLE SAVINGS BY FUMIGATION AND DRYING

Grade	As marketed		If Fumigated		If Dried	
	†Cars	Discounts	Cars	Discounts	Cars	Discounts
1920-1921 Crop						
No. 1	46		51		484	
No. 2	403		448		868	
No. 3	393	$14,148	470	$16,920	174	$6,264
No. 4	328	27,552	429	36,036	52	4,368
No. 5	67	8,844	80	10,560	16	2,112
Sample	364	52,416	123	17,712	7	1,008
Garlicky*	(789)	119,296	(789)	119,296	(79)	12,110
Total Discounts	1,601	$222,256	1,601	$200,524	1,601	$25,862
Cost of Fumigation and Drying.			$19,212		$24,015	
Saving			2,520		172,379	
1921-1922 Crop						
No. 1	29		96		255	
No. 2	206		526		785	
No. 3	176	$6,336	485	$17,460	294	$10,584
No. 4	118	9,912	222	18,648	60	5,040
No. 5	20	2,640	40	5,280	22	2,904
Sample	869	125,136	49	7,056	2	288
Garlicky	*660	99,792	660	99,792	66	9,979
Total Discounts	1,418	$243,816	1,418	$148,236	1,418	$28,795
Cost of Fumigation and Drying.			$17,016		$21,270	
Saving			78,564		193,751	

TABLE VI—Continued.

1922-1923 Crop

Grade	As marketed		If Fumigated		If Dried	
No. 1	4		5		13	
No. 2	120		154		564	
No. 3	206	$7,416	439	$15,804	757	$27,252
No. 4	242	20,328	490	41,160	139	11,676
No. 5	33	4,356	240	31,680	45	5,940
Sample	920	132,480	197	28,368	7	1,008
Garlicky*	(699)	83,880	(699)	83,880	(70)	8,388
Total Discounts	1,525	$248,460	1,525	$200,892	1,525	$54,264
Cost of Fumigation and Drying.			$18,300		$22,875	
Saving			29,268		171,321	
1923-1924 Crop						
No. 1	81		115		201	
No. 2	278		502		553	
No. 3	72	$2,592	157	$5,652	91	$3,276
No. 4	36	3,024	50	4,200	11	924
No. 5	7	924	24	3,168	4	528
Sample	388	55,872	12	1,728	2	288
Garlicky*	(383)	45,960	(383)	45,960	(38)	4,560
Total Discounts	862	$108,372	862	$60,708	862	$9,576
Cost of Fumigation and Drying.			$6,036		$7,545	
Saving			41,628		91,251	

*Cars labelled "garlicky" included in count under separate grades; discounts added in with grade discounts to arrive at total discount.
†Cars estimated on basis of 1200 bushels per car.

TABLE VI EXPLAINED

Table VI shows the interesting results of a study of discounts actually suffered by producers and shippers of Pennsylvania-grown wheat at terminal markets. The facts revealed give a general idea of the large losses which may be expected if wheat is shipped to a terminal market without proper attention. For example, during the crop year of 1920-1921, there were 1601 cars of wheat shipped from various parts of Pennsylvania to the export elevators of Philadelphia and Baltimore. On arrival at those two points the cars were inspected and graded by licensed inspectors using Federal grades, as already discussed. The table shows how these 1601 carloads graded upon arrival at the elevators and the actual discounts suffered for all wheat graded No. 3 or lower because of high moisture, moth damage or the presence of garlic. The total discounts amounted to $222,256 for the one season.

The most instructive part of Table VI are the figures showing discounts and actual savings resulting after fumigation of the grain to eliminate moth damage and after drying to reduce moisture content. By fumigation the discounts could have been reduced from $222,256 to $200,524 and by drying this could have been further reduced to $25,862 making an actual saving of $172,379.

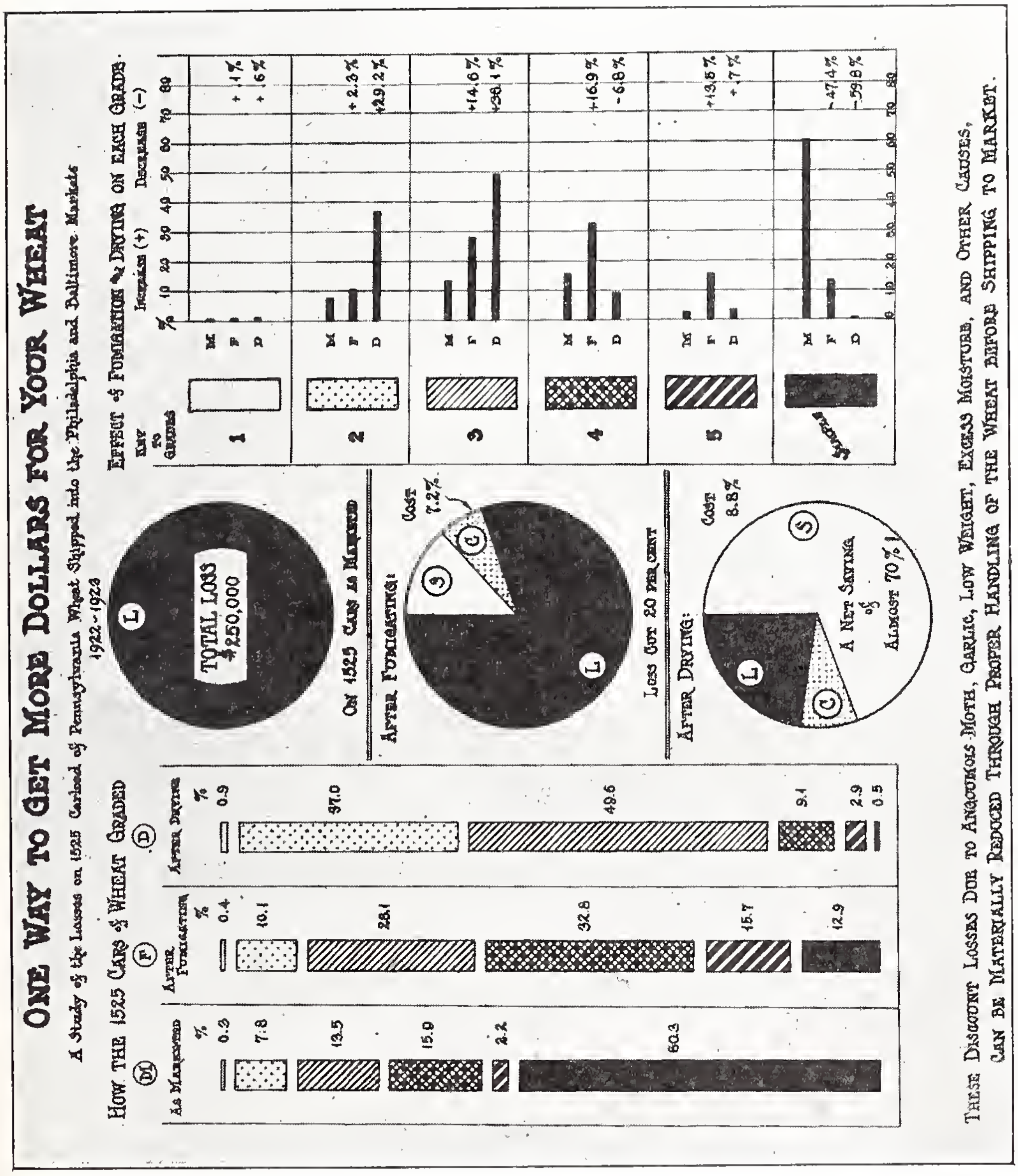
Only 46 cars of the 1920-1921 crop graded No. 1 when marketed. If the entire 1601 cars had been dried, it is estimated that the amount grading No. 1 would have been increased to 484 cars. Also the amount grading No. 2 would have been increased from 403 cars to 868 cars. The amount in Sample Grade would have been reduced from 364 to only 7 cars. Therefore, as a result of drying, the discount would have been reduced from $222,256 to $25,862, making a saving, after deducting cost of drying, of $172,379. Similarly drying the 1418 cars of the 1921-1922 crop would have resulted in an estimated saving of $192,751. The 1922-1923 crop, represented by 1525 cars, could have been increased in value $171,321. The 862 cars of the 1923-1924 crop could have been improved so that 201 cars rather than only 81 would have graded No. 1 and 553 cars rather than 272 grade No. 2, resulting in an estimated saving of $91,251.

The cost of drying is small compared to the total saving that results. It is estimated that the cost of drying 1601 cars in 1920-1921 would have been about $24,015; 1418 cars in 1921-1922, $21,270; 1525 cars in 1922-1923, $22,875; 862 cars in 1923-1924, $7,545.

During the four years covered by Table VI, 5406 carloads of wheat were received at Philadelphia and Baltimore from Pennsylvania for export. The total discounts suffered during this period was $822,904. The amount of this that could have been saved by fumigation is estimated at $151,980 and if local elevators had proper drying facilities, this saving would have reached the astonishing total of $628,702.

CHART III

Graphic Presentation Showing How 1922 Wheat Crop Actually Graded and How Large Savings Would Have Resulted from Fumigation and Drying of Grain.



(M) represents the grade received at terminal market.
(F) shows how the wheat would have graded if fumigated before shipping.
(D) shows how the wheat would have graded if dried before shipping.
(L) represents the loss suffered by farmers and shippers because of moth infestation, garlic and high moisture.
(C) is the cost of fumigation and drying.
(S) represents the saving as a result of fumigation and drying.

TABLE VII

HOW GRADES RECEIVED AT TERMINAL MARKETS ON CAR SHIPMENTS FROM LEADING COUNTIES COULD HAVE BEEN IMPROVED BY FUMIGATION AND DRYING

County	Amount* No. 1 Wheat			Amount No. 2 Wheat			Amount No. 3 Wheat			Amount No. 4 Wheat			Amount No. 5 Wheat			Amount Sample			Total	Amount Garlicky	Per cent Garlicky
	When marketed	If Fumigated	If Dried	When marketed	If Fumigated	If Dried	When marketed	If Fumigated	If Dried	When marketed	If Fumigated	If Dried	When marketed	If Fumigated	If Dried	When marketed	If Fumigated	If Dried			
Adams	9	14	32	18	38	82	30	59	58	35	57	14	3	9	0	93	11	2	188	40	21
Berks	0	5	46	51	108	199	45	96	77	39	63	19	14	65	7	200	12	1	349	129	37
Bucks	2	2	13	3	20	29	4	22	31	7	24	17	0	22	4	79	5	1	95	90	95
Chester	0	1	1	28	67	265	47	169	231	84	199	63	19	72	32	419	89	5	597	542	91
Cumberland	11	19	100	72	90	98	54	66	28	29	35	5	2	4	3	67	21	1	235	179	76
Dauphin	0	0	10	16	29	53	13	27	37	13	19	5	3	21	5	65	14	0	110	35	32
Delaware	0	0	0	4	10	34	8	22	15	7	17	7	3	7	3	37	3	0	59	44	75
Franklin	9	11	34	43	50	57	27	33	17	10	11	4	0	4	0	24	4	1	113	94	83
Lancaster	58	112	343	267	471	724	186	362	266	198	327	41	22	47	6	649	61	0	1380	655	47
Lebanon	17	26	44	53	127	247	65	102	100	53	78	17	16	42	2	207	36	1	411	43	10
Lehigh	19	28	62	55	82	139	33	46	21	33	39	4	9	16	0	77	15	0	226	30	14
York	18	28	100	116	215	436	149	318	310	142	224	46	17	36	14	468	89	4	910	357	39
Total	143	246	785	726	1307	2363	661	1322	1191	650	1093	242	108	345	76	2385	360	16	4673	2238	48

* Total for 1920, 1921, 1922 and 1923 given in carloads.

TABLE VII EXPLAINED

Table VII gives the total car shipments from each county shipping more than 10 cars of wheat to the terminal markets of Philadelphia and Baltimore. The figures given are the total for the four years, 1920, 1921, 1922, and 1923. It will be noticed that the amount of No. 1 wheat could have been almost doubled by fumigation and increased more than five times by drying the grain before marketing. The astonishing fact is that only 143 out of a total of 4,673 cars or about 3 per cent graded No. 1 wheat when marketed. Over 2,300 cars, that is, more than 50 per cent of the total, went into Sample Grade largely because of damage by the grain moth. More than 2,200 cars, or 2,640,000 bushels, were found to be garlicky and because if it suffered a discount of 7 to 10 cents per bushel. How each of the important wheat producing counties stands in respect to amount of garlicky wheat marketed, and as to the actual grade of wheat when marketed as well how it could have been improved by fumigation and drying are shown in Table VII.

For example, a total of 188 carloads of wheat were received from terminal markets from Adams County during the four years. Only 9 cars of this amount graded No. 1 when marketed. If the entire quantity shipped had been fumigated, 14 cars would have graded No. 1 and if dried 32 cars. Likewise, while only 18 cars graded No. 2 when marketed, 38 would have graded No. 2 if the entire amount had been fumigated, and 82 cars if dried. On the other hand, the quantity grading Sample was 93 cars when marketed. If the grain had been fumigated, it is estimated that only 11 cars would have gone into this grade, and if dried, only 2 cars.

During the four years covered by this study, 1380 carloads were shipped from Lancaster County to the terminal markets. Of this quantity 58 cars graded No. 1 when marketed and 267 cars No. 2. If the entire quantity had been properly dried, it is estimated that 343 cars would have graded No. 1 and 724 cars No. 2. The amount grading Sample, it is estimated, would have been reduced from 649 cars to zero. Taking the 597 carloads shipped from Chester County, we find that not any graded No. 1 when marketed and 28 cars graded No. 2. By thorough drying, it is estimated that at least 265 cars would have graded No. 2 and the amount grading Sample would have been reduced by the same operation from 419 cars to 5 cars. Taking the total of 4673 cars shipped from the 12 counties during the four years, it can be seen that only 143 cars graded No. 1 when marketed and 726 No. 2. If the entire quantity had been fumigated, it is estimated that at least 246 cars would have graded No. 1 and 1307 No. 2. If dried, it is estimated that 785 cars would have graded No. 1 and 2363 cars No. 2. At the same time the amount grading No. 4 would have been reduced from 605 to 242 cars, the amount grading No. 5, from 108 cars to 76 cars, and the amount grading Sample from 2385 cars to 16 cars.

TABLE VIII

SUMMARY OF GRADES AND REGRADES FOR SEASONS OF 1920, 1921, 1922, AND 1923 IN PER CENT OF TOTAL ANNUAL RECEIPTS

Year	Per Cent No. 1 Wheat			Per Cent No. 2 Wheat			Per Cent No. 3 Wheat			Per Cent No. 4 Wheat			Per Cent No. 5 Wheat			Per Cent Sample			Per Cent Garlicky		
	When Marketed	If Fumigated	If Dried	When Marketed	If Fumigated	If Dried	When Marketed	If Fumigated	If Dried	When Marketed	If Fumigated	If Dried	When Marketed	If Fumigated	If Dried	When Marketed	If Fumigated	If Dried	When Marketed	If Fumigated	If Dried
1920	2.8	3.2	30.2	25.1	28.0	54.2	24.5	29.3	11.0	20.4	26.8	3.2	4.5	5.0	1.0	22.7	7.7	.4	49.0	49.0	5.0
1921	2.0	6.8	18.0	14.6	37.1	55.3	12.4	34.3	20.8	8.3	15.7	4.2	1.4	2.8	1.5	61.3	3.4	.2	46.0	46.0	5.0
1922	.2	.3	8	7.8	10.1	37.0	13.6	28.1	49.6	15.9	32.6	9.2	2.2	15.8	3.0	60.3	12.9	.4	46.0	46.0	5.0
1923	9.3	13.3	23.3	32.2	58.2	64.1	8.3	18.5	10.6	4.2	5.8	1.3	.8	2.8	.5	45.2	1.4	.2	44.5	44.5	4.5

Table VIII shows the percentage of cars which graded under the respective grades when marketed and what they would have graded after fumigation and after drying. When the Federal grades for wheat were established, it was supposed that about 75 per cent of the wheat would grade No. 2 or better when marketed. This table shows that during the four year period only 21.6 per cent of the Pennsylvania-grown wheat was so graded. However, if this same wheat had been fumigated and dried before shipping about 70 per cent would have graded No. 2 or better. Fumigation and drying during the 1923 season would have increased the amount falling into these two grades from 41.5 to 87.4 per cent and would have saved farmers $91,251 if they owned properly equipped elevators.

TABLE IX

CAR SHIPMENTS OF WHEAT FROM LEADING COUNTIES SHOWING NUMBER OF CARS GRADING "SAMPLE" BECAUSE OF GRAIN MOTH INFESTATION.

S. G. Means Sample Grade

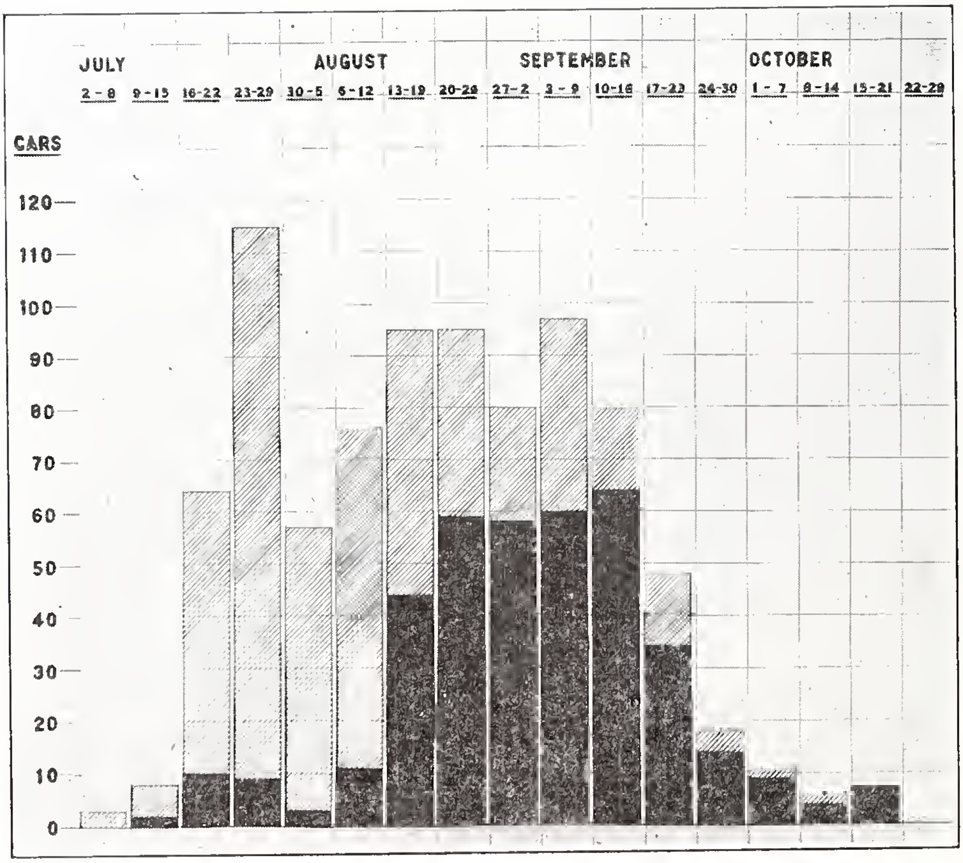
County	July		August		September		October		Total		Per cent
	Cars	S. G.	Cars	S. G.	Cars	S. G.	Cars	S. G.	Cars	S. G.	S. G.
Adams	6		6	2	21	16	1	1	34	19	55.9
Berks	11	2	23	16	19	19	1	1	54	38	70.3
Bucks	1	1	8	6	5	5	2	2	16	14	87.5
Chester	12	2	27	17	37	27	1	1	77	47	61.0
Cumberland	2		2	1	17	9			21	10	47.6
Dauphin	4	1	3	2	3	3	1	1	11	7	63.6
Delaware	2		6	4	2	2	1	1	11	7	63.6
Lancaster	70	2	128	59	53	29	4	2	255	92	36.1
Lebanon	28	4	35	20	21	21			84	45	53.6
Lehigh	20		32	11	18	18			70	29	41.4
York	41	8	85	26	53	26	5	3	184	63	34.2
All others*	15		11		9	8	8	8	43	16	37.2
Total	212	20	366	164	258	183	24	20	860	387	
Per Cent of Total		9.4		44.7		70.9		80			45.0

*"All others" includes Beaver, Bedford, Cameron, Centre, Clarion, Clinton, Franklin, Huntingdon, Mifflin, Montgomery, Montour, Perry, Philadelphia, Schuylkill, Union and Westmoreland counties.

Table IX is a summary of car shipments by months from the respective counties, showing the number of cars infested with Angoumois Grain Moth. It will be noticed that the wheat which was cut early threshed early, and marketed during July and the early part of August showed only a small percentage of moth infestation, 9.4 per cent for July and 44.7 per cent for August. The wheat which was marketed later in August and during September and October showed a very decided increase in moth infestation, 70.9 per cent in September and 80 per cent in October. This grain graded Sample Grade and received large discounts at terminal markets. During November the percentage of infestation began to decrease because of colder weather and gradually disappeared. However, grain, held over until spring, containing moth infestation, will develop again and infest the fields.

Heavy Loss Due to Grain Moth.

It will be noted since the survey began that approximately 50 per cent of the wheat marketed has graded Sample Grade because of the Angoumois Grain Moth, and even increased to 60 per cent during year 1922-1923, but dropped back to 45 per cent of the grain marketed in 1923-1924. The smaller percentage this year may be accounted for by better harvesting conditions which enabled more threshing to be done in the fields which permitted earlier marketing, or it may be the result of a campaign put on by the Extension Entomologists of State College and the Pennsylvania Department of Agriculture during the winter of 1922 and spring of 1923. The Entomologists gave talks on cleaning up the barns and graneries and demonstrated methods of fumigating. The farmers and shippers were more open to suggestions after the exceedingly large losses from the previous year. Altho the percentag of cars grading Sample Grade because of the presence of live moth remains practically the same or less, yet the percentage of grain damaged before fumigating is increasing each year. This makes it more and more difficult for the miller to mill a higher quality of flour.



The light shaded portions show total shipments by weeks. The dark shaded portions show cars infested with Angoumois Grain Moth.

Loss due to Foreign Material: Approximately 10 per cent of the crop marketed each year has graded below A No. 2 into the lower grades because of cockle, chess and other foreign materials. It is estimated that the average discount on that percentage of the grain marketed would be something like seven cents per bushel. If this grain is representative of the crop raised in Pennsylvania, and we believe it to be so, then the producer is losing approximately $500,000 each year because of carelessness in growing and marketing foreign material in his wheat.

Loss Due to Garlic: Although the survey shows that some counties marketed wheat of which 90 per cent graded garlicky yet the average of the wheat marketed from the whole state was graded 50 per cent garlicky. This does not mean that 50 per cent of the farms raising wheat have garlic on the farms but on account of the methods of marketing, one farmer's load of wheat in a car may contaminate the whole car and cause eight or ten other farmers to receive a discount on their clean wheat. The marketing of the 1923 wheat crop shows that 43.6 per cent of the cars grading garlicky were graded light garlicky, meaning three or less bulblets in 1,000 grams; 37.1 per cent graded medium garlicky, meaning 4-15 in 1,000 grams; and 19.3 per cent graded heavy garlicky, meaning over 15 bulblets in 1,000 grams.

An analysis of all cars of wheat grading Garlicky at the Philadelphia market in 1921 showed that 50 per cent of all the cars originating in Pennsylvania graded "Garlicky." The only available records were on 275 cars which showed that 75 per cent contained less than 10 garlic bulblets in 1,000 grams and only about 20 per cent of the cars grading "Garlicky" had over 15 garlic bulblets in 1,000 grams.

Maryland estimates that 96 per cent of all the wheat grown in Maryland contains garlic of which 75 per cent or over contains 10 or more garlic bulblets in 1,000 grams. Delaware is estimated to be in the same class as Maryland.[1] Garlic is much less in Pennsylvania wheat yet the Pennsylvania farmers received the same discounts for wheat grading garlicky as those other states whose wheat contains much larger quantities. The present Federal grades providing three classes for garlicky wheat are ineffective because there is no distinction in price between the three classes and no effort made to keep them separate in storage. If the "light" and "medium" classes were combined into one group, it probably would be possible to develop a demand for this class, particularly among domestic mills. Such an increase in demand would necessarily reduce the discount prevailing on this class as compared with the wheat containing a large amount of garlic.

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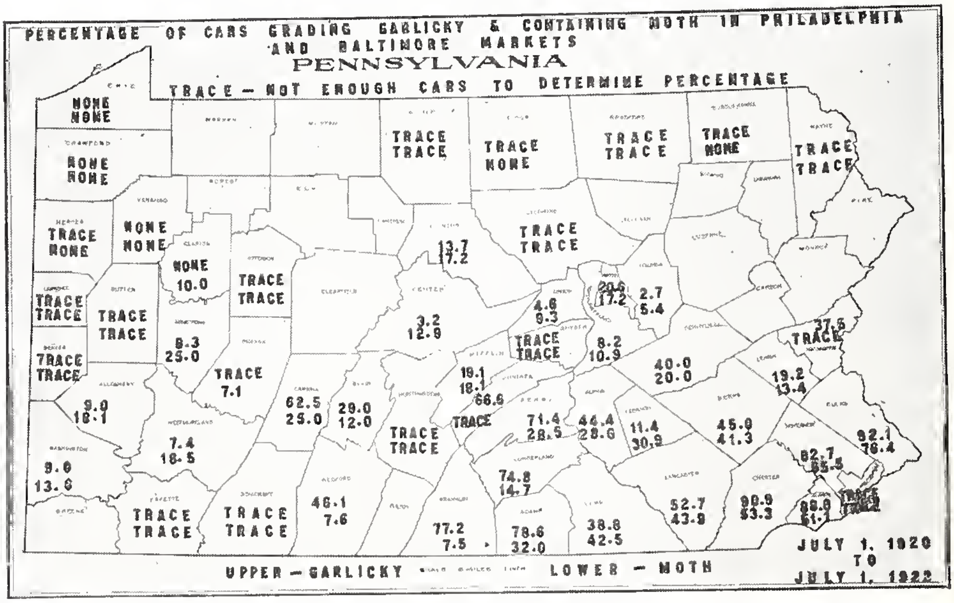
(1) University of Maryland Bulletin No. 30

Loss Due to High Moisture Content. The survey showed that during the crop year July 1, 1920 to July 1, 1921, 53 per cent of the grain marketed was below No. 2 because of high moisture: 18.5 per cent graded No. 3 because of moisture; 23.4 per cent graded No. 4 because of moisture; 4.0 per cent graded No. 5 because of moisture; and 7.0 per cent graded sample because of moisture.

During crop year July 1, 1921 to July 1, 1922 approximately 30 per cent of the grain marketed was below No. 2 because of moisture; 13.0 per cent graded No. 3 because of moisture; 11.0 per cent graded No. 4 because of moisture; 2.0 per cent graded No. 5 because of moisture and 4.0 per cent graded sample because of moisture. During crop year July 1, 1922 to July 1, 1923 approximately 50 per cent graded below No. 3 because of high moisture; 24.0 per cent graded No. 4 because of moisture; 13.0 per cent graded No. 5 because of moisture; and 13.0 per cent graded Sample because of moisture. The 1923 crop showed approximately 16 per cent below No. 2 because of moisture; 8 per cent grading No. 3; 4 per cent grading No. 4; 2 per cent grading No. 5; and 2 per cent grading Sample Grade.

The losses due to Angoumois Grain Moth, garlic, and excess moisture content should be given considerable study by the producer. A grain drier in the community would cut these losses to a minimum for heat would not only kill the moth but would remove all excess moisture and make it possible to remove approximately 90 per cent of the garlic. This could all be done at one operation and cheaper than fumigation alone.

CHART IV



Percentage of cars by counties grading Garlicky (upper figure) and containing moth (lower figure) in Philadelphia and Baltimore market.

MILLING INDUSTRY IN PENNSYLVANIA.

During year 1920, there were 1742 flour and grist mills reported in Pennsylvania but according to the 1923 report, there were only 606 establishments actually doing business with a capital investment estimated at $21,915,900 and a market value of product including flour and grist $43,235,100. A total of 2,512 people were employed and salaries of $2,680,500 were paid. The value of the product shipped outside of the state was $12,471,900, showing that a large amount went into stock feed and stayed on the farm. Also a large amount of wheat which did not go to the export market was shipped to southern millers.

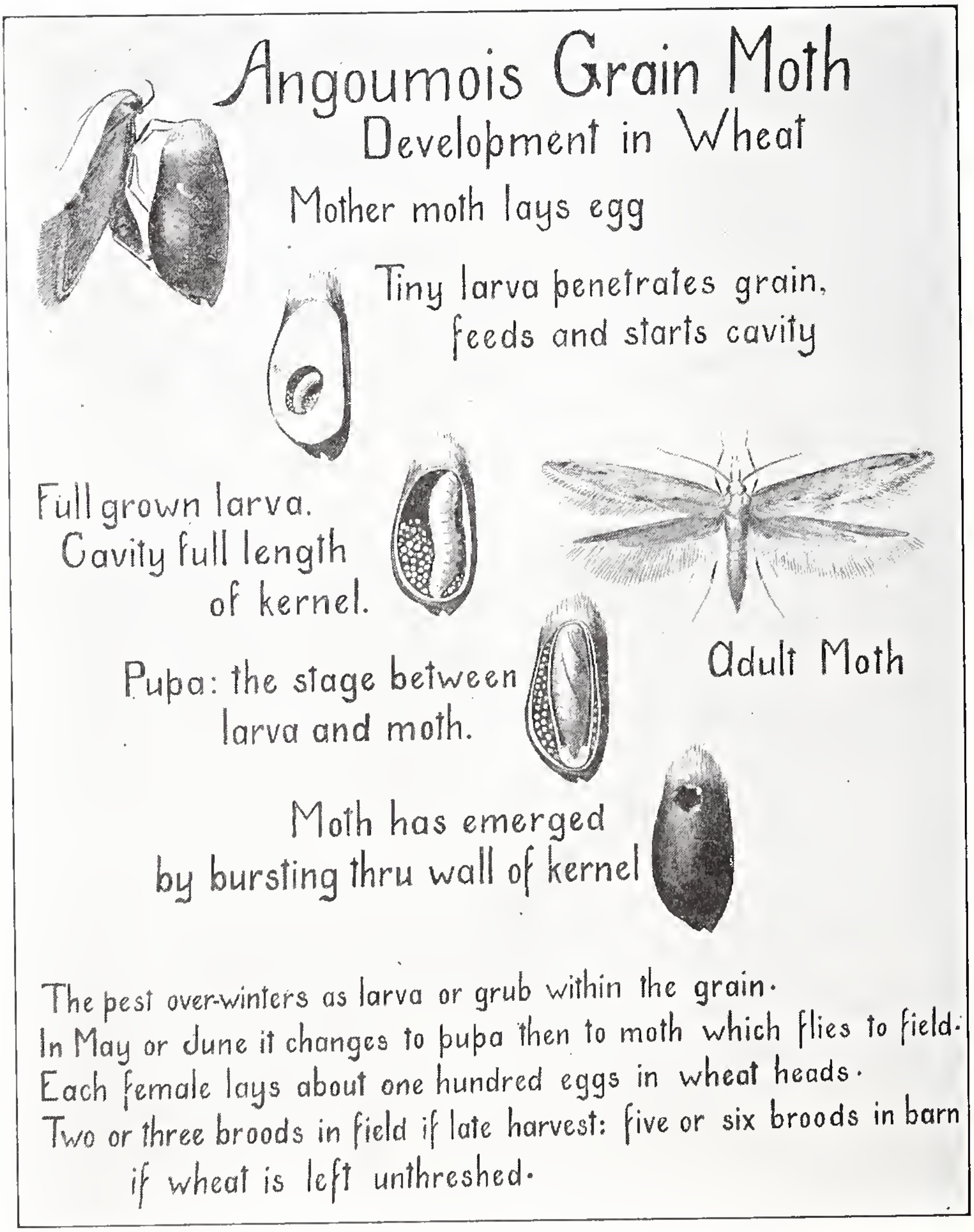
As previously stated the Pennsylvania millers have not practiced the purchasing of wheat by grade but have been in the habit of paying the same price for wheat regardless of cleanness or quality. Because of the scarcity of storage space, this wheat has been stored in the same bins and has greatly hampered the ability of the miller in producing a uniform flour of good quality. This is especially true since each year brings a large percentage of moth infested wheat along with the garlic and foreign material. Bakers are unable to use the flour satisfactorily and larger amounts each year are thrown on the export market at a very low price.

There is still a big demand for Soft Red Winter flours for cracker, pretzel and pastry purposes but because the Pennsylvania millers have neglected to purchase by grade, segregating the hard and soft texture wheat, they have been unable to mill a flour of uniform strength and quality. Consequently, they have gradually lost this trade to millers in Michigan, Ohio, Indiana and Missouri. Pennsylvania wheat properly segregated and milled separately would furnish a flour of exceptional quality for crackers, pretzels and pastry.

Moth Infested Wheat Makes Poor Flour.

The fact that 60 per cent of the wheat marketed at terminal markets was infested with Angoumois Grain Moth, gives a general idea of the damage which has prevailed in Pennsylvania wheat. Some cars of wheat which we have personally inspected, were so badly damaged from moth infestation that the wheat was unfit for human consumption. Farmers have been advised to cut their wheat early and thresh direct from the field, if possible. If not possible, the grain should be stacked outside rather than mowed in a hot barn, and then fumigated as soon after threshing as possible. Bins should be made as near air tight as possible in order to make a complete kill of moth and worm. The farmer should not depend on using large amounts of carbon bisulphide to take the place of a leaky bin for it is not only more expensive but is not more effective and may harm the milling quality of wheat. If the wheat has become badly infested, and many of the kernels have been bored or already contain worms, fumigating may prevent further damage but the grain will always be of inferior quality for milling. Fumigating at that time may kill the worms in the kernel but usually the worm is as heavy as what he has eaten. There is great difficulty in removing such kernels in screening or cleaning, and they frequently follow the sound wheat to the break rolls. Consequently, the worm and excrement of the worm are milled in the flour and produce an odor or flavor to the bread which is objectionable and which has caused much flour to be rejected. If this badly infested wheat is run through a commercial dryer, the juices of the worm are extracted, making the kernel light and it is blown out in cleaning and does not become a part of the flour.

CHART V (Angoumois Grain Moth)[1]


Angoumois Grain Moth
Development in Wheat
Mother moth lays egg
Tiny larva penetrates grain, feeds and starts cavity
Full grown larva. Cavity full length of kernel.
Adult Moth
Pupa: the stage between larva and moth.
Moth has emerged by bursting thru wall of kernel

The pest over-winters as larva or grub within the grain.
In May or June it changes to pupa then to moth which flies to field.
Each female lays about one hundred eggs in wheat heads.
Two or three broods in field if late harvest: five or six broods in barn if wheat is left unthreshed.

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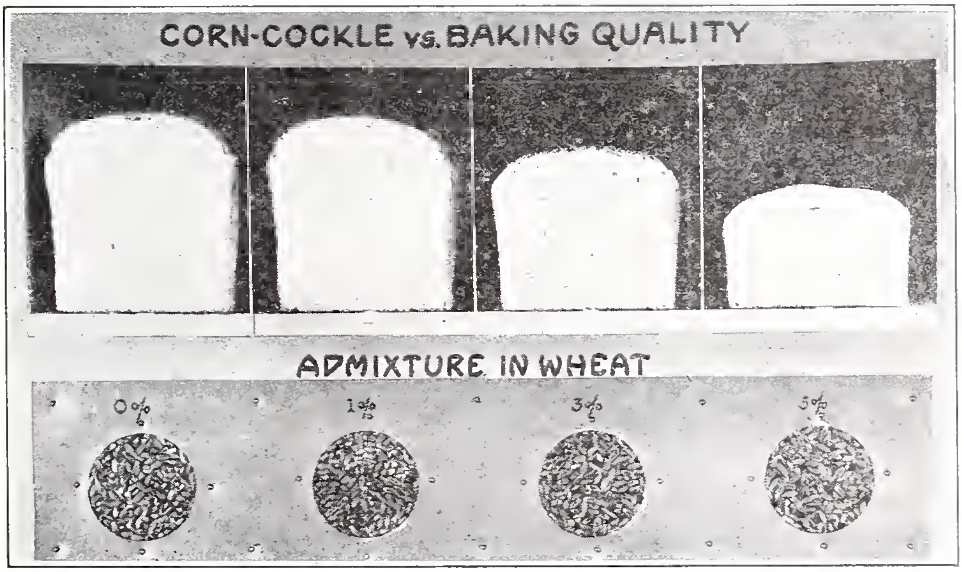
[1] Adapted from Farmers' Bulletin 1156 United States Department of Agriculture.

Foreign Matter Reduces Value of Wheat.

Some foreign materials in wheat (such as rye, oats, barley, etc.) have a certain feed value, while other constituent parts of foreign material (such as cockle, chess, etc.) not only have no feeding value but are actually harmful as a feed. The expense of removing the foreign material at elevators or flour mills at the present time affects the commercial value of the wheat. Farmers seldom receive anything for the dockage as foreign material when they sell to the shipper or miller, but on the other hand are discounted on the value of the wheat if too much is present. More care should be taken by the farmer to keep these foreign materials from the fields, and if much is present the wheat should be cleaned before marketing. Such foreign materials like cockle, must be removed before milling, if the wheat contains more than one per cent. Cockle contains a poisonous substance called "sepanine" which causes a reduction in loaf volume and if present in the amounts of two to five per cent affects not only loaf volume but the color, texture and flavor of the bread.

CHART VI



Corn Cockle in Wheat Injures the Baking Quality of Flour.*

Effect of Milling Garlic in Wheat.

In order to determine the number of garlic bulblets that could be present before they actually affected the milling quality of the wheat and bread baked from the flour, the Department secured the services of an expert miller, Mr. B. W. Dedrick, Professor of Milling Investigations at Pennsylvania State College and also the cooperation of the United States Department of Agriculture to make baking tests on the flour.

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* Tests and Charts by United States Department of Agriculture.

TABLE X—BAKING TESTS OF 37 SAMPLES OF GARLICKY WHEAT SHOWING EFFECT OF GARLIC ON ODOR OF FLOUR AND FLAVOR OF BREAD MADE FROM SUCH WHEAT[2]

Number	Condition of Sampling	Number of Garlic Bulblets per 1000 grams	Degree of Odor of Garlic in Wheat	Degree of Odor of Garlic in Flour	Odor of Garlic in Hot Bread	Odor of Garlic in can when opened	Odor of Garlic present during mixing	Flavor or Taste of Bread	Odor of Garlic in Cold Bread
8577	Uncleaned	9	......	Rather sl.	None	None	Slight	Normal	None
8578	1st Br. Rolls	4	......	Slight	None	Very sl.	Slight	Normal	None
8579	1st Br. Rolls	3	......	Very sl.	None	Slight	Very slight	Normal	None
8580	Uncleaned	8	......	Very sl.	None	Slight	Very sli.	Normal	None
8581	1st Br. Rolls	2	......	Very sl.	None	None	None	Normal	None
8582	Uncleaned	4 to 6	......	V. V. sli.	None	V. sli.	Slight	Normal	None
8583	1st Br. Rolls	4	......	V. V. sli.	None	V. sli.	V. sli.	Normal	None
8584*	1st Br. Rolls	5	......	V. V. sli.	None	Slight	None	Normal	None
8585*	Uncleaned	20	......	V. V. sli.	None	None	Slight	Normal	None
8586	1st Br. Rolls	1	......	Barely perc.	None	Slight	None	Normal	None
8595	Uncleaned	70	Some	Slight	None	Slight	Slight	Normal	None
8596	1st Br. Rolls	10	Quite strong	Slight	Slight	Slight	Slight	Normal	None
8597	Uncleaned	11	......	Slight	None	Slight	Slight	Normal	None
8598	1st Br. Rolls	11	......	Slight	Slight	Slight	Slight	Normal	None
8599	Uncleaned	200	Musty	Slight	Slight	Slight	Slight	Normal	None
8600	1st Br. Rolls	12	Strong	Slight	Slight	Slight	Slight	Normal	None
8601	1st Br. Rolls	13	Strong	Slight	None	Slight	Slight	Normal	None
8602	Uncleaned	12	None	Stronger	None	Slight	Medium	Normal	None
8603	1st Br. Rolls	8	Strong	Slight	None	Slight	Slight	Normal	None
8604	Uncleaned	10	......	Little str.	Slight	Medium	Medium	not normal tho	None
								Not def. garlic	
8605	Uncleaned	44	Strong	Very sli.	Very sli.	Medium	Medium	Not def. garlic	None
8606	1st Br. Rolls	6	Not so strong	Very sli.	None	Medium	Medium	Not def. garlic	None
8607	Uncleaned	10	......	Slight	None	Medium	Medium	Must & sl. g.	None
8608	Uncleaned	20	......	Slight	None	Medium	Medium	not normal tho	None
8609	Uncleaned		None					Not def. garlic	
	1st Br. Rolls	3	None	Stronger	Very sli.	Medium	Medium	Not def. garlic	None
8640	Cl.-1st Br. R.	3	Some	Slight	None	None	None	Normal	None
8641	Uncleaned	9	......	Slight	None	None	None	Normal	None
8642	1st Br. Rolls	3	Some	Quite str.	None	None	Very sli.	Normal	None
	Uncleaned	11	......		None	None	in sponge		
8643	Uncleaned	10	None	None	None	None	None	Normal	None
	1st Br. Rolls	3	None						
8689	Uncleaned	8	......	Very sli.	None	None	Very sli.	Normal	None
8690	1st Br. Rolls	2	Very sli.	Very sli.	None	None	Very sli.	Normal	None
8691	Uncleaned	......	None	None	None	None	None	Normal	None
8692	1st Br. Rolls	......	None	None	None	None	None	Normal	None
8705	Uncleaned	0	None	None	Musty	Musty	None	Normal	None
	1st Br. Rolls	0	None						
8706	Uncleaned	23	......	Very sli.	None	None	None	Normal	None
	1st Br. Rolls	3	Slight						
8707	Uncleaned	6	......	Slight	None	Sl. musty	None	Normal	None
	Uncleaned	250	Some						
	1st Br. Rolls	10	Quite strong						
8708	1st Br. Rolls	40	Strong	Very strong	Slight	Slight	Medium	Very sli.	None
	Uncleaned	30	Some garlic						

*The two samples contained in the mailing bags had different markings and there is some question as to whether these samples were paired off correctly. [1]Nos. 8577 to 8586 inclusive, from Lakeview Milling Company, Chambersburg, Pa. Nos. 8595 to 8609 inclusive, from Quaker City Mills, Philadelphia, Pa. Nos. 8640 to 8692 inclusive, from Hershey Mills, York, Pa. Nos. 8705 to 8708 inclusive, from Littlestown Mills, Littlestown, Pa. [2]Milling investigations, U. S. Bureau of Agricultural Economics.

In the summary written by Mr. Dedrick covering the work completed on the milling of garlicky wheat, this statement is made: "Garlic does not affect the flour to any appreciable extent. Bread baked from such flour has no garlicky odor or flavor unless very heavily charged, then the odor or flavor may be very slight. It does affect the milling to a slight degree even when a small amount is present, causing the mills to shut down once or twice a day to clean rolls." However, a discount of two cents a bushel will adequately pay for all such trouble especially when wheat does not contain more garlic than most Pennsylvania wheat.

The amount of garlic present for several mills showed that in all the tests there were not more than an average of 19.4 garlic bulblets in 1,000 grams found in the unclean wheat, with an average of not more than 4.9 garlic bulblets to the 1,000 grams going to the first break rolls after cleaning. This would indicate that all mills are able to remove approximately 75 per cent of the garlic with ordinary cleaning machinery without extra cost of cleaning. With care they could easily remove more even when the garlic is new and full of juice. If the grain could be run thru a commercial grain dryer 90 per cent or even more can be readily removed.

THE BAKING INDUSTRY IN PENNSYLVANIA.

"The importance of the baking industry in Pennsylvania is probably not appreciated as much by those who are engaged in it as those of us who are in a position to make a comparison of facts and figures which show its relation to other industries in the Commonwealth," states Mr. M. Hoke Gottschall, Director of the Bureau of Statistics and Information, Pennsylvania Department of Internal Affairs.

In 1922 the number of establishments in Pensylvania were 1852; the capital investment $43,826,600; and the market value of product $109,008,000, of which $5,773,200 was shipped outside of the state. When classed under food and kindred products, it ranks second in value, following the sugar refining industry with a value of $114,409,000. Wage earners in the baking industry numbered 18,422 in 1922 and earned $26,144,400 during that year.

There are ten establishments in Pennsylvania engaged in the manufacture of ice cream cones. These plants turned out in 1922, 71,924,800 cones, a volume sufficient to allow 42 cones for every pupil in the public schools of Pennsylvania between the ages of 5 to 20 years. The pretzel manufacturing is also a very important part of the baking industry and in York County 23 per cent of the value of the baking industry represents pretzel manufacture.

	Bread, etc..	Pretzels	Per Cent
York, ...	$2,495,900.00	$511,610.00	23.0
Berks, ...	2,929,600.00	332,631.00	11.4
Lehigh, ...	2,453,100.00	183,445.00	7.5
Lancaster, ...	2,209,000.00	158,391.00	7.2
Dauphin, ...	1,699,100.00	97,143.00	5.7
Lebanon, ...	793,600.00	60,585.00	7.6

Both the ice cream cone and pretzel industries use large quantities of flour from soft red winter wheat. The decline in the quality of local flour forced these industries to purchase a large part of their supply from other states. An improvement in flour should restore this outlet for our flour.

The baking industry of Pennsylvania is utilizing nearly five million barrels of flour annually at the present time. Why are the bakers not using more Pennsylvania milled flour? *Bakers in all parts of the state have repeatedly remarked that they have been compelled to discontinue the use of Pennsylvania flour because the millers did not deliver a dependable flour which could be used satisfactorily. Interest shown during the past by the bakers makes it certain that they will return to the use of Pennsylvania flour just as soon as the millers take the following steps to improve the quality of their flour:*

First. Encourage the farmer to raise a better quality of wheat by paying a premium for the best grades.

Second. Segregate texture, milling the starchy wheat for a pastry flour, and milling the dark vitreous texture wheat for bread flour.

Third. Have enough storage space available to segregate by grade and texture and have sufficient supply to guarantee uniform milling.

Fourth. Take care to remove all of the foreign materials before milling which are harmful to flour.

Fifth. Blend the soft winter flour with hard Red Spring flour, to insure a satisfactory bread flour to the baker.

Twenty-four state institutions equipped for baking used approximately 30,000 barrels of flour in 1923. Because of past troubles with Pennsylvania milled flour, these institutions have in most cases discontinued its use, and are purchasing flour from western mills.

FARMERS, MILLERS AND BAKERS MUST COOPERATE.

If wheat production is to become profitable in Pennsylvania, the farmer and the miller must cooperate with each other to produce a flour which will meet the legitimate requirements of the baker. The methods to follow and the results which can be secured have been developed in work by the Bureau of Markets with a miller in Lycoming County, but are applicable in most communities in Pennsylvania.

Each wagonload of wheat was examined and graded as it came to the mill. A premium was paid for wheat of hard texture and the better grades. The soft texture wheat was stored separately and milled into a pastry flour, which was favorably received by the trade. The hard texture wheat was stored separately and after milling, this flour was blended with an equal amount of flour milled from No. 1 Dark Northern Spring wheat. This blend retained the good characteristics of both wheats, the spring wheat flour adding high water absorption and loaf volume to the recognized good color, texture and flavor of the soft Red Winter flour. Samples of this blended flour tested by commercial bakers resulted in favorable reports and large orders. The chief problem since that time has been to secure enough wheat of the required characteristics in the community, in spite of the fact that a premium of 15 to 20 cents per bushel has been paid for such wheat.

Further proof of the value of this flour is contained in a letter from the laboratory of the Ward Baking Company who tested this flour for a baker who expected to use the flour commercially.

> "We are very sorry to have held you up on the analysis of your flour but owing to the possibility of a slip up we made a second analysis of your flour in order to be absolutely sure of its merits. This in our opinion is a wonderful grade of flour, having a very high wet and dry gluten content and low ash and standard ratio. We would be very pleased to have you send us the name of this flour as we are always on the lookout for something good."

A statement from the laboratory of the W. E. Long Company of Chicago regarding a test of the blended flour reads:

> "This flour is of good strength and very good quality. It is much stronger than the average Southwestern Winter wheat flour and is strong enough to be suitable for bread making without the addition of spring wheat flour."

The attitude of the bakers of the state is evidenced in the following interview with Mr. Frederick C. Haller, President of the Pennsylvania State Bakers Association: "We have just made a discovery of material interest to the farmers of Pennsylvania. We have never been able—I mean large baking establishments—to use Pennsylvania wheat to any advantage. This latest discovery is, that a mixture of 50 per cent Manitoba wheat and 50 per cent Pennsylvania wheat forms a combination that produces what is believed to be as fine a quality of bread as any made exclusively from western flour.

"Our farmers have been growing wheat without any regard to its chemical constituents. Just so it is wheat, and a good crop, they are satisfied. For instance, one farmer will seed his fields with one kind of wheat and the neighbor next to him will sow another kind. The result is, there is no uniformity in the product. In my own establishments, if we get a consignment of flour with a protein content of, say, 11 per cent one day, and the next day we get another consignment with 10 per cent, it plays havoc with our output.

"A baker must have absolute uniformity in his flour to make good bread. The public is very discriminating. It does not care anything about the processes involved in the manufacture, chemical constituents, heat units, patent ovens and all that. It pays for the best bread, and demands it.

"Every big baking concern nowadays maintains a laboratory. It has been found that Manitoba wheat being hard and Pennsylvania wheat much softer, the combination produces excellent results. We believe we have made a discovery of great value to Pennsylvania agriculturists."

Both the Pennsylvania farmer and miller must realize that the export trade for wheat and flour from this country at satisfactory prices has greatly decreased because of competition from countries like Canada and Australia where production costs are considerably lower than they can be in an industrial territory such as Pennsylvania. The domestic market, therefore, will become of increasing importance in the future. The population of Pennsylvania requires approximately 50,000,000 bushels of wheat annually which is double the average production of the state. The loss of the export market for American wheat will result in much keener and closer competition between the various producing districts of the country for the larger American consuming markets of which Pennsylvania is one of the most important.

BAKERS REQUIRE UNIFORM FLOUR.

Under modern living conditions, the commercial baking industry is the chief purchaser of flour both for bread and pastry purposes. Uniformity of quality is the first requisite as every large bakery maintains a laboratory to test materials. For bread purposes the baker requires a flour of approximately 11 per cent gluten, standard ratio, low ash, and water absorption of approximately 60 per cent. For pastry the baker requires a flour of fine texture, good color, low ash, and low gluten of approximately 6 per cent to 7 per cent. In order to satisfactorily market his flour in the future, the Pennsylvania miller must supply a product which will meet the requirements of the commercial baker at home if possible. For bread flour, the miller must use the higher grades of the hard texture soft winter wheat, free from insect damage and foreign material, strengthened by the addition of hard red spring wheat. To secure uniformity, he must increase his bin capacity to permit storage by grade and texture, and to insure a sufficient supply of wheat for years round operation and sales. There are some mills in the state which will be handicapped by their location and which will not be in a position to take advantage of the milling in transit privilege for blending with spring wheat. These millers should not overlook the necessity for buying by grade and segregating texture, as they can sell their hard texture wheat either in the form of grain or flour, to mills which are blending.

Uniformity is just as important in pastry flour as in bread flour. Fortunately, the softer texture wheat is best for this purpose. If kept uniform in quality, an increasing trade can be developed for pastry flour at satisfactory prices. There seems to be an opportunity for the development of profitable sales for a dependable pastry flour in small packages.

FEWER VARIETIES OF GOOD MILLING WHEAT NEEDED

The production of a limited number of good milling varities of cleaner wheat coupled with segregation of grades and textures so as to mill uniform flour is the most important single step which can be taken to improve both the quality and price of Pennsylvania wheat and flour. The miller has an equal interest with the farmer in achieving this purpose, and should take the lead in securing this development. Financial inducement is the surest and quickest way to encourage it. Purchasing by grade and the payment of a premium for the better quality of wheat will achieve the desired result sooner than any other method. The payment of a reduced price for the poorer grades will necessarily result in dissatisfaction among the farmers producing this inferior grain. Experience in the grading of other commodities shows that if the product of a farmer is graded as it leaves his possession, and he is paid accordingly, a decided improvement in quality results very soon over the entire community.

Tests already conducted in every wheat growing county of the state by the county agents show that a few varieties are best from a production standpoint in all sections. These varieties have also proved very satisfactory in milling and baking tests and in actual commercial use. The farmer should seek the advice of his county agent in determining the best variety to grow in his community. It is likely that the acreage of wheat in the state will not be decreased to any great extent, because of its relation to the crop rotation and the dairy and live stock industries. As there is no other crop that can be substituted for it in the crop rotation under present conditions, every effort should be made to make the crop a profitable one by use of the best varieties, planting of clean seed, protecting against insect damage, and providing better storage facilities so that the wheat does not need to be sold immediately after harvest.

Nearness to market insures a higher price to Pennsylvania wheat growers over their competitors in the western states. If the farmers will grow only a few varieties of the best milling qualities, and the millers increase their storage, purchase by grade and segregate texture so as to mill an absolute uniform flour, there is an opportunity to interest the commercial baker in the State. Pennsylvania contains one-twelfth of the population and one-sixth of the baking industry of the United States. If farmers and millers take advantage of this splendid home market, the industry will not be forced to compete with other countries on the export market, and a more satisfactory return will result.